COMMONWEALTH MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXVII JUNE 1948

MARCHIONATTO (J. B.). **Hongos parásitos de las plantas, nuevos o poco conocidos en la Argentina.** [Parasitic fungi of plants, new or little known in Argentina.]—*Publ. misc. Minist. Agric. B. Aires*, Ser. A, iii, 37, 11 pp., 3 col. pl., 2 figs., 1947.

Alternaria herculea [*A. brassicae*] was observed for the first time in Argentina in July, 1943, on wild radish and subsequently recorded on radish and turnip in Buenos Aires and La Plata, causing heavy damage in all cases. Radishes in the same districts are also attacked by *Cercosporella albomaculans* [*R.A.M.*, xxiv, p. 217], first recognized in May, 1944.

Corticium areolatum [*C. solani*: ibid., xxiii, p. 315] was collected on bitter orange leaves in Misiones in July, 1942, in association with *Colletotrichum* and *Ascochyta* spp.

Fusicladium orbiculatum was found in April, 1937, forming irregularly circular, chestnut-coloured lesions, 3 to 6 mm. in diameter, on the leaves of *Sorbus domestica*, while the fruits bore circular chestnut or greyish, later cracked areas, 6 to 9 mm., predominating on the upper parts. The conidiophores are compact, simple, cylindrico-conical, 18 to 20 by 4 to 4·5 μ, with the upper part transversely striate and the apex truncate, and giving rise to a single subclavate conidium, 16 to 18 by 5·5 to 6 μ, of the same olivaceous colour as the conidiophore. Synonyms of the species include *F. dendriticum* vars. *orbiculatum* and *sorbinum*, while the perithecial state is known as *Venturia inaequalis* var. *cinerascens*.

Ovularia lolii, collected on *Lolium multiflorum* in La Plata, produces on the leaves elongated (2 to 3 mm.), discrete, brown lesions with yellow, shaded margins; the caespitose, cylindrical, erect, hyaline conidiophores measure 60 to 80 by 4 to 5 μ and bear acrogenous, oval or subpiriform, smooth, hyaline conidia, 18 to 19 by 11 to 13 μ. A note by Sarasola describing *O. viciae* on *Vicia villosa* has already appeared [ibid., xxvi, p. 341].

Pseudopeziza trifolii was collected on red clover at La Plata in November, 1941.

Sclerotinia sclerotiorum was isolated from soy-beans from Plá (Buenos Aires) in April, 1944, making a new host record for the fungus in Argentina.

Scolecotrichum graminis [ibid., xxii, p. 99; xxiii, p. 491; xxvi, p. 493] was observed on wheat and rye at La Plata in August, 1927.

Septoria avenae [ibid., xxv, p. 155] was collected on oats in Buenos Aires in September, 1943, this being a new host record for Argentina. The perfect state, *Leptosphaeria avenaria* [loc. cit.], has not yet been recorded in the country.

Reference has already been made to the discovery of *Sphaerella linorum* on flax [ibid., xviii, p. 595 *et passim*].

DUPIAS (G.). **Contribution à l'étude des Urédinées de la Haute-Garonne.** [Contribution to the study of the Uredineae of the Haute-Garonne.]—*Bull. Soc. Hist. nat. Toulouse*, lxxviii, pp. 32–52, 1943. [Received 1947.]

Among other records of interest in this critically annotated list of rusts of the Haute-Garonne may be mentioned *Melampsora medusae* on poplar (*Populus angulata*) [*R.A.M.*, xxi, p. 498], a new species for the region and probably for

France and Europe. *Lathyrus macrorhizus* is believed to be a new host for *Uromyces fabae* and *Sorbus domestica* for *Gymnosporangium juniperi*.

NICOLAS (G.) & AGGÉRY [BERTHE]. **Notes phytopathologiques (troisième note). Notes phytopathologiques (quatrième note).** [Phytopathological notes (third note). Phytopathological notes (fourth note).]—*Bull. Soc. Hist. nat. Toulouse*, lxxvii, pp. 33–41, 1942; lxxix, pp. 223–230, 1944. [Received 1947.]

The writers list and critically discuss a number of interesting additions to the Pyrenean mycoflora collected at and around Toulouse [cf. *R.A.M.*, xiii, p. 716].

PETRAK (F.). **Plantae sinenses a Dre. H. Smith annis 1921–1922, 1924 et 1934 lectae. XLII. Micromycetes.** [Chinese plants collected by Dr. H. Smith during the years 1921–1922, 1924, and 1934. XLII. Micromycetes.]—*Acta Hort. Gothoburg.*, xvii, pp. 113–164, 1947.

Included in this critically annotated list of Chinese microfungi are 21 new species and one new combination. Mention may be made of *Cronartium ribicola* on *Ribes coeleste* in Shensi; *Gymnosporangium haraeanum* [*R.A.M.*, xxiii, p. 156] on *Pyrus lindleyi* and *P. serotina* [*P. pyrifolia*]; *Phyllachora maculans* on *Bambusa stenostachya*; *Cercospora cannabina* on hemp [ibid., ix, p. 613], and the following new species.

G. sikangense produces on *Cotoneaster adpressa* leaves circular or elliptical, isolated or occasionally confluent, carmine-reddish, later dark red-brown spots, 2 to 3·5 mm. in diameter, surrounded by a pale yellowish or yellow-brown, mostly ill-defined zone of variable width. The epiphyllous, gregarious, blackish pycnia measure 150 to 180 μ in diameter; the hypophyllous, mostly gregarious aecidia are united at the base to a short cylindrical or very broadly truncate conical, gall-like protuberance, 500 μ in height, on the leaf; the deeply lacerate and fimbriate peridia are 0·5 to 1 mm. long, their cells measuring 60 to 100 by 15 to 24 μ; the globose, seldom broadly ovoid or ellipsoid, sometimes obtuse angular, transparent yellow-brown aecidiospores measure 24 to 35 by 23 to 28 μ, and are furnished with a densely verruculose membrane, 3 to 5 μ in thickness.

Epicoccum sinense n.sp. on *Astragalus sinicus* leaves was previously identified by Keissler (apud Handel–Mazzetti, Symb. Sin., ii, p. 18, 1937) as *P.* [*Cymadothea*] *trifolii* [ibid., xiv, p. 367].

WHITE (W. L.) & DOWNING (MARY H.). **The identity of 'Metarrhizium glutinosum'.** —*Mycologia*, xxxix, 5, pp. 546–555, 2 figs., 1947.

The authors call attention to the need for further inquiry into the true identity of the fungus at present known as *Metarrhizium glutinosum* [*R.A.M.*, xxiii, p. 494; xxvii, p. 84], the first isolate of which was numbered 1334.2 (the type); two further isolates, 1334.1 and 1334.3, were obtained later from Maryland soils. In the authors' opinion, the name is unfortunate and misleading because (1) it places the species nearest to an insect-inhabiting form to which presumably it bears no close relationship in biological activity; (2) it breaks the continuity of the literature; and (3) the addition to the literature of new names for organisms with long prior records and which ought to be identified is a practice to be vigorously condemned.

A comparison of 1334.2 with Preston's descriptions and illustrations of *Myrothecium verrucaria* [ibid., xxiii, p. 191; xxvi, p. 502] disclosed no perceptible differences, and other comparisons with American herbarium material confirmed the conclusion that the American cultures named *Metarrhizium glutinosum* were in fact conspecific with the British cultures of *Myrothecium verrucaria* [ibid., xxvi, p. 474]. Hence, *Metarrhizium glutinosum* Pope should be referred to synonymy under *Myrothecium verrucaria* (Alb. & Schw.) Ditm. ex Fr.

A detailed comparison of the microscopic characters and growth on potato dextrose agar of a subculture from one of Preston's isolates (from a canvas shoe in England) with those of 1334.2 revealed no differences whatever. A culture of *M. roridum* from tomato fruits [ibid., xxvi, p. 473] showed only a slight difference in growth pattern, which was of no significance. The two species appeared to be very closely related, the best, and perhaps the only, distinguishing character being the spores, which in *M. verrucaria* are more or less ovoid, with a peculiar and characteristic outline, whereas those of *M. roridum* are narrow and cylindric. The cultures 1334.1 and 1334.3 and subcultures of the isolates cited by Preston of *M. verrucaria* all represented the same species.

In comparative tests of their cellulolytic activity the ability of the English and American strains of *M. verrucaria* to break down cellulose was about equal, whereas that of the American strain of *M. roridum* was rather weaker. The appearance of the three cultures on the fabric test strips after 90 hours' incubation showed little or no difference between the two strains of *M. verrucaria*, though the visible growth of *M. roridum* was comparatively light. Subcultures of the other isolates cited by Preston under *M. verrucaria* and *M. roridum* also showed strong cellulolytic action.

Evidence from herbarium material and written records indicates that both *M. verrucaria* and *M. roridum* are of widespread occurrence in North America, Europe, and the tropics, but among several thousand cultures from deteriorated cotton fabrics and related military and industrial materials, mostly from tropical exposures, these two species appeared only a few times; *M. verrucaria* was not encountered on several hundred mouldy samples carefully examined. The latter fungus appears, in fact, to be of small significance as a destroyer of cotton fabrics in the field.

Tunstall (A. C.) & Sarmah (K. C.). **Notes on stem diseases of Tea.**—*Mem. Tocklai Exp. Sta. Indian Tea Ass.* 16, 77 pp., 12 pl. (3 col.), 1947.

The introduction to this useful memorandum on the stem diseases of tea is concerned with a rational pruning system as a means of obviating infection. Great importance is attached to the management of plucking of vigorous bushes, which should be carried out in such a way as to leave plenty of carbohydrate reserves in the roots when the time comes for drastic pruning. Dying-back will thus be reduced to a minimum and a more rapid healing of wounds ensured. Large wounds low down on the inside of the frames are particularly apt to cause trouble and should be avoided wherever possible by the removal of unwanted branches while they are still small. The recent tendency to perform heavy pruning operations before the end of the rapid growth period is a factor in the development of sun scorch [*R.A.M.*, xxii, p. 114]. As a rule, the treatment of rotting branches is not economical, their excision to forestall involvement of the main frame being cheaper and more satisfactory. Eradication and replacement are usually advisable where the centre of the frame is decayed, though these measures may be postponed until the flushing capacity of the bushes is obviously reduced. Most of the pruning cuts on bushes in normal health heal of their own accord, but large wounds or those in the centre of the frame should be protected by the annual application of bitumen paint until recovery is complete.

Following the introduction is a classification index, summarizing the most conspicuous features of the several diseases, which are then more fully discussed, with recommendations on treatment, in the ensuing nine chapters, viz., I, diseases initiated by vegetable parasites; II, diseases associated with animal parasites; III, diseases associated with dead snags; IV, diseases initiated by adverse climatic and cultural conditions; V, diseases affecting the stems of seedlings; VI, organisms attacking dead tissue; VII, organisms grown on the surface—not known to penetrate living tissues; VIII, abnormalities; and IX, mycological notes.

The fungal diseases of chapter I fall into two parts, comprising (*a*) attacks limited to the branches, caused by *Nectria cinnabarina* [ibid., vii, p. 746], thread blight [ibid., iv, p. 67], and pink disease (*Corticium salmonicolor*); and (*b*) attacks extending to and from the roots, due to *Helicobasidium compactum*, *Ustulina zonata*, *Rosellinia arcuata*, and *Hypoxylon asarcodes*, all included in a paper on root diseases of tea published in 1940 [ibid., xix, p. 368].

The diseases associated with animal parasites (chapter II) are the sooty moulds *Capnodium* sp., *Meliola* sp., and *Limacinula theae* [*Phaeosaccardulina javanicum*: ibid., xx, p. 313]; *Aschersonia* sp.; *Septobasidium bogoriense*, the agent of velvet blight, and other *S.* spp. [ibid., x, p. 557]; rosette blight, possibly connected with eelworm infestation and characterized by an abnormal thickening of the shoots at the top of the branch, marked shortening of the internodes, and reduction in the size of the leaves, which are produced in a bunch; and cankers arising from the suppressed growth of adventitious buds, perhaps resulting from insect depredations.

The dead snag diseases listed in chapter III are caused by *Poria hypobrunnea*, *Irpex destruens*, *Auricularia auricula-judae*, *Fomes applanatus* [*Ganoderma applanatum*], *F. lucidus* [*G. lucidum*], *F. lignosus*, *Aglaospora* sp. (all included in the above-mentioned paper on root diseases), and *Massaria theicola* [ibid., xii, p. 147].

Pathogens operating under conditions unfavourable to the host (chapter IV) are *Macrophoma theicola* [regarded by Petch as the imperfect stage of *Desmotascus neglectus*: ibid., x, p. 760], *Glomerella major* n.sp., *Botryodiplodia theobromae*, *Sphaerostilbe repens* [ibid., xix, p. 368], *Corticium dealbans* n.sp. [ibid., vii, p. 746], and two forms of red rust, the parasitic *Cephaleuros parasiticus* and the epiphytic *C. mycoidea* [the relegation of the latter to synonymy with the former species is not accepted: ibid., xxi, p. 392].

G. major was frequently isolated from the apparently sound portions in proximity to rotting lesions on old wood, as well as from sickly one- to three-year-old branches. It produces very variable, immersed or erumpent perithecia, 130 to 150 μ in diameter, usually with beaked ostioles, with or without an apical tuft of brown hair, sometimes spinose, punctate, or verrucose, the beaks, when present, being cylindrical or subconical, up to 160 by 100 μ; the opaque, black walls are up to 50 μ in thickness. The aparaphysate asci measure 70 to 110 by 10 to 18 μ and each ascus contains eight elliptical, often slightly inequilateral, usually brown-walled, uni- to bi-, rarely triseptate ascospores, 15·6 to 30·1 by 5·5 to 8·4 (mean 24·9 by 7) μ. The imperfect (*Colletotrichum*) state is characterized by simple or branched, brown-walled, bi- to triseptate, clavate conidiophores, about twice the length of the conidia, with an enlarged apical cell, 6 to 8·5 μ in diameter, and brown to opaque brown, subacute setae, 100 to 200 by 4·5 to 5 μ, with up to four septa. The mostly cylindrical conidia measure 14·4 to 30·6 by 4·8 to 9·6 (24·8 by 7·7) μ and are uni- to triseptate at germination.

Corticium dealbans bleaches the bark of young wood, the whiteness of which is in striking contrast to the normal colour of the dead strips of primary cortex outside the invaded area. Infection usually originates at forks on the young woody stems, spreads over the whole of the brown bark, and sometimes extends to the cortex of the older stems. The fructifications are pinkish patches, $\frac{1}{2}$ to $1\frac{1}{2}$ by $\frac{1}{8}$ to $\frac{3}{8}$ in., bearing numerous basidia up to 11 by 8·7 μ, with two to four sterigmata, up to 6·5 by 2·2 μ, and broadly elliptical or oblong, hyaline, continuous basidiospores, 7·8 to 11·7 by 4·3 to 6 μ.

The seedling stem diseases mentioned in Chapter V include a collar rot caused by *Phomopsis* sp. and infections by *Pythium*, *Rhizoctonia*, and *Gibberella* spp.

The organisms attacking dead tissues (Chapter VI) are *Aleurodiscus* sp. (formerly known as *C.* sp. 2) [ibid., v, p. 137], the fructifications of which develop in subcircular, chalky-white patches, $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter, often on dead twigs of bushes invaded by *C. dealbans*; *Stilbum* [*Graphium*] *nanum*, ubiquitous in north-east India,

forming numbers of pinkish-red, pin-shaped fruit bodies 1 to 1½ mm. in height, with round, white caps, on dead twigs; horse-hair blight (*Marasmius equicrinis*) [ibid., xxiv, p. 121], and several species of *Nectria*.

Of the two superficial fungi included in chapter VII, the [undetermined] agent of white stem blight produces effects closely resembling those of *C. dealbans*. The former, however, may be found on one- to three-year-old branches, whereas the latter is mostly confined to one-year-old wood. Moreover, in white stem blight the primary cortex is missing and the surface is quite smooth instead of retaining shreds of the brown primary bark, as in the case of *C. dealbans*. From the stem the fungus passes to the under surface of some of the leaves, imparting a silky, rather dull, white appearance to the diseased patch, the colour of the corresponding area of the upper surface being yellowish-green. The progress of infection is slow and the blemish is easily removable by a single application of strong lime-sulphur after pruning. The epiphytic thread blight caused by *M. pulcher* [ibid., xvi, p. 170] may be distinguished from the parasitic form described in chapter I by the fan-shaped films of mycelium on the older branches, while the lower leaf surfaces are traversed by slender threads.

The abnormalities comprised in chapter VIII, besides the above-mentioned rosette blight and cankers, are apple foliage blight, fasciation, and zig-zag branches. The name 'apple foliage blight' is descriptive of a condition in which several thin, wiry shoots, with some of the leaf edges serrated, and others smooth, develop from one point, lending a 'witches' broom' aspect to the bushes. The formation of zig-zag branches is associated with very poor rooting capacity and significantly correlated with susceptibility to rim blight [*Cladosporium* sp.].

ALLDAY (C.). **Blister blight. The influence of early tipping on yield.**—*Tea Quart.*, xix, 2, pp. 45–48, 1947.

The author suggests that the 'tipping' of tea bushes in Ceylon should be effected when the tips of about half the primary shoots have reached the tipping level on half the bushes. In this way, all the secondaries do not grow simultaneously and therefore they are not all susceptible at the same time to attack by blister blight [*Exobasidium vexans*: *R.A.M.*, xxvii, p. 198]. This method provides protection against isolated infection periods, the bushes are brought into plucking earlier, and the cost of tipping is greatly reduced. Knives are unnecessary except for any fringe lungs, and if the second tipping is correctly timed, i.e., is carried out when the primaries left untipped at the first tipping are just above tipping level, approximately 12 days later, the tippers can bring in up to 45 lb. green leaf per head from medium 'jat' fields.

COCHRAN (G. W.). **A chromatographic method for the detection of Tobacco-mosaic virus in juice from diseased Turkish Tobacco plants.**—*Phytopathology*, xxxvii, 11, pp. 850–851, 1 diag., 1947.

A simple paper-chromatographic method has been adapted for tobacco mosaic virus tests from that devised by Consden *et al.* for the separation of amino acid mixtures (*Bio-chem. J.*, xxxviii, pp. 224–232, 1944). The equipment consists of a glass cylinder used as a support for a large rubber or cork stopper, on which is placed a porcelain embedding dish. Glass microscope slides are inserted in cuts made in the stopper on each side of the dish to support strips of Whatman No. 1 filter paper, 2×8 in., one end of which is inserted in the dish and the other longer end hangs down in the jar. The apparatus is placed in a large glass jar fitted with a tight cover and having a little water in the bottom to produce a saturated atmosphere.

To make the test a drop of plant sap is placed on the paper strip 1½ in. below the top end, sap from healthy plants being used in the control. Of the colour reactions tested

with purified tobacco mosaic virus, the Sakaguchi arginine reaction appeared to be the most sensitive. The reagents used for the test are applied to the filter paper with an atomizer in the following order: (1) 10 per cent. aqueous potassium hydroxide, (2) 0·1 per cent. alpha naphthol in 50 per cent. ethyl alcohol, and (3) 5·25 per cent. sodium hypochlorite (undiluted chlorox). When a solution capable of dissolving the virus is added to the dish it is taken up by the paper and moves the virus to a new position in its downward passage. The presence of arginine is indicated by the appearance in about one minute of a bright pink colour, which fades after a few minutes. Arginine being present also in normal plant proteins, the success of the test depends on the ability of the solvent system to move the virus, but not the normal arginine-containing proteins, to a given spot on the paper strip. When the advancing front of the solvent approaches the bottom of the paper, the strip is removed, dried, and treated with arginine reagents to indicate the location of the virus.

It was found necessary to buffer water at a pH level of 4·5 or upwards to move the virus and secure a satisfactory colour test; at pH 6 to 7, for instance, this requirement was fulfilled and the transported virus recovered in a highly active state. The best method of recovery was to run two strips simultaneously under identical conditions, colour reagents being applied to one to locate the position of the virus, which was then outlined with pencil on the other. The spot was cut out and the virus removed from the paper by elution with buffer. When water buffered at pH 4·5 or upwards was used as the solvent, most of the normal arginine-containing proteins and the chlorophyll remained at the site of application and did not interfere with the colour test for the virus.

Köhler (E.). **Studien über den Infektionsverlauf bei Verimpfung des Tabakmosaik- und des Paratabakmosaikvirus auf Nicotiana glutinosa und Nicotiana tabacum (var. White Burley). Ein Beitrag zum Resistenzproblem.** [Studies on the course of infection on the inoculation of the Tobacco mosaic and the para-Tobacco mosaic virus into *Nicotiana glutinosa* and *Nicotiana tabacum* (var. White Burley). A contribution to the resistance problem.]—*Arch. ges. Virusforsch.*, iii, 6, pp. 303–326, 1 fig., 1 diag., 4 graphs, 1947.

A comprehensive, fully tabulated account is given of the author's studies at the Research Institute, Celle, Hanover, on the course of infection by the closely related viruses of tobacco and para-tobacco mosaic (*Ber. dtsch. bot. Ges.*, lxi, p. 175, 1943), herein designated TM and PTM, respectively, in mechanically inoculated *Nicotiana glutinosa* and White Burley tobacco leaves. In both hosts the infection foci appeared as gradually expanding spots with intensely necrotic centres and, but for a few exceptions in the case of TM, they were limited to the inoculated leaves. Notwithstanding undeniable differences of detail, therefore, the two viruses obviously encounter the same type of resistance.

The continuous examination of the active virus content in the *N. glutinosa* leaves following inoculation revealed a constant decrease from the second day onwards at the latest, until a lower limit was eventually reached; at the same time the growth of the infection foci came to a standstill. An exception to this rule occurred in the case of PTM on White Burley, in which the active virus, after an initial check lasting for several days, steadily increased and simultaneously the infection foci continually expanded.

The observations are interpreted as follows. In the infection foci the two opposite processes of virus multiplication and virus inactivation proceed concurrently. In the case of TM on *N. glutinosa* inactivation predominates over multiplication at an early stage, steadily encroaching on the expanding periphery of the lesion and there inhibiting the multiplication of the virus until finally all reproductive activity is terminated and with it the spread of the infection focus. On the other hand, in the

PTM foci on White Burley, the process of virus multiplication gains increasing ascendancy over that of inactivation, so that ultimately the former makes unimpeded progress, just as in the case of 'normally susceptible' hosts. The localization of the disease on the inoculated leaf in these experiments was evidently due to the inactivation of the virus as it reached the phloem. The actual mechanism of inactivation of the virus in the infection focus and in the phloem has not yet been elucidated, but without doubt a specific defensive reaction of the invaded host tissue is involved.

Atropa belladonna is recorded as a new host of [potato] virus X (strain Cs 44) [cf. *R.A.M.*, xix, p. 113; xxii, p. 400], in which the multiplication of the infective principle proceeds extraordinarily slowly.

STEINBERG (R. A.). **Growth responses to organic compounds by Tobacco seedlings in aseptic culture.**—*J. agric. Res.*, lxxv, 3, pp. 81–92, 5 figs., 1947.

In experiments carried out in the United States, seedlings of the Robinson strain of Maryland Medium Broadleaf tobacco were grown aseptically for 28 days in a mineral agar nutrient medium in 200 c.c. Pyrex Erlenmeyer flasks at 25° C. illuminated by 500 foot-candles of fluorescent white light. Most of the characteristic symptoms of frenching [*R.A.M.*, xxv, p. 322 and next abstract], notably strap-leaf formation, reticular chlorosis, cessation of stem growth, and increase in leaf number, appeared as a specific toxicity response to *dl*-isoleucine. Admixtures of other amino acids with the last-named caused responses varying from diminution to accentuation of the frenching symptoms. It is suggested that unbalanced mineral nutrition leads to the formation of characteristic symptom patterns in plants, which are caused by excess supplies of free amino acids resulting from abnormal protein metabolism.

STEINBERG (R. A.). **Growth responses of Tobacco seedlings in aseptic culture to diffusates of some common soil bacteria.**—*J. agric. Res.*, lxxv, 7–8, pp. 199–206, 4 figs., 1947.

In studies made to determine whether any of the common species of soil bacteria form diffusates able to produce abnormal alterations in the gross morphology of tobacco plants, Xanthi Turkish tobacco seedlings were grown aseptically [see preceding abstract] in 50 c.c. of a mineral agar solution containing 200 p.p.m. bactopeptone. Stab inoculations of the agar were made $\frac{3}{4}$ to $1\frac{1}{2}$ in. from the stems with some 60 species and strains of presumably non-pathogenic soil bacteria. Growth of the bacteria was usually limited to the inoculation stab and did not appear to interfere with root growth. The symptoms produced in the aerial parts included different types of chlorosis simulating various mineral deficiencies, epinasty, cupped, narrow, and strap leaves, and leaves with lobes, hooked tips, and roll. A frenching-like reticular chlorosis was caused by the diffusate from *Serratia marcescens*, epinasty by that from *Corynebacterium simplex*, and chlorosis resembling iron deficiency by *Aerobacter aerogenes*. In the presence of sucrose, *A. aerogenes* caused yellow bud, *C. simplex* induced cupped and spotted leaves, and *Pseudomonas aeruginosa* gave a uniform, minus-sulphur type of chlorosis. In cultures inoculated with *C. tumescens* the seedlings showed epinasty and long, narrow leaves, while in those inoculated with *Erwinia carotovora* or *Bacillus cereus* they developed a well-defined, reticular chlorosis and later narrow, strapped leaves with lobed or scalloped edges. In cultures inoculated with *B. pumilus* (without sucrose) epinasty and the terminal bud necrosis developed, while in the presence of sucrose epinasty and narrow, hooked, rim-rolled leaves occurred. Further tests were made with 29 strains of *B. pumilus* to determine the range of symptoms obtained from a single species in the absence of sucrose. Eighteen strains produced no abnormality, and some of the seedlings appeared to be more vigorous than the controls. The

symptoms associated with the remaining 11 strains included stunting, epinasty, 'concave-up' leaves and marginal uproll, and short stem. Reticular chlorosis was associated with one strain, and marginal uproll with another.

It was ascertained that the symptoms were correlated with the distance and number of the bacterial colonies, age of the seedlings, and the bacterial strain. An analogy is drawn between the hormonoid effects obtained in these experiments and the symptoms of tobacco frenching.

Smith (T. E.) & Clayton (E. E.). **Inheritance of resistance to bacterial wilt in Tobacco.**—*J. agric. Res.*, lxxvi, 1, pp. 27–32, 1 fig., 1948.

In co-operative experiments carried out by the North Carolina Agricultural Experiment Station and the United States Department of Agriculture from 1941 to 1943, resistance to bacterial (Granville) wilt of tobacco (*Bacterium* [*Xanthomonas*] *solanacearum*) [*R.A.M.*, xxv, p. 189; xxvi, pp. 333, 570] was found to be recessive and controlled by multiple genes. A cross between the slightly resistant, flue-cured varieties Davis Special and Pinkney Arthur yielded a moderately resistant genotype. Genotypes possessing high resistance were T.I. 448A and 79-X. Segregates from crosses between T.I. 448A and flue-cured varieties possessed growth and quality characteristics superior to those from similar crosses having 79-X as the source of resistance. Of the flue-cured varieties used as parents, No. 400 [ibid., xxvii, p. 47] produced the most progeny with high resistance and good agronomic characters. After crossing T.I. 448A with a susceptible tobacco and back-crossing resistant segregates to susceptible tobacco, full T.I. 448A resistance was not recovered until the F_5 generation. Further selection gave no increased resistance above the level of T.I. 448A. From 52,000 hybrid plants of T.I. 448A parentage, only five potentially valuable genotypes have been retained.

Valleau (W. D.) & Johnson (E. M.). **The relation of meadow nematodes to brown root rot of Tobacco.**—*Phytopathology*, xxxvii, 11, pp. 838–841, 1947.

Meadow nematodes (*Paratylenchus pratensis*) were present in large numbers in the roots of Burley tobacco suffering from brown root rot in a part of the Kentucky Agricultural Experiment Station where the disease occurs annually, as well as in those of crops known to produce conditions favouring brown root rot when preceding tobacco in the rotation, e.g., timothy [*Phleum pratense*: *R.A.M.*, xxv, p. 50], maize, orchard grass [*Dactylis glomerata*], bluegrass [*Poa pratensis*], and other grasses, clovers, *Lespedeza*, lucerne, and soy-bean, and of many common weeds. In other fields, where tobacco develops rapidly following transplanting and is not affected by brown root rot, meadow nematodes have not been found or only in very small numbers. There is reason to believe that the brown root rot of tobacco in Ontario is the same as that in Kentucky, for tests on five varieties (Canada 354, susceptible; Canada 364, resistant; Harrow Velvet, highly susceptible; Ky 33, and a local Kentucky variety, Canadian, both resistant) gave the same reactions at the two localities. This strongly suggests the causal agent is the same in both places. While these observations do not constitute a final proof that *Paratylenchus pratensis* is exclusively concerned in the causation of the disease they do at least furnish convincing evidence that the nematodes inflict severe injury of the brown root rot type on tobacco and various other crops tending to failure in Kentucky and neighbouring States.

Biraghi (A.). **Il cancro del Castagno causato da Endothia parasitica.** [Chestnut canker caused by *Endothia parasitica*.]—Reprinted from *Ital. Agric.*, *1946*, 7, 9 pp., 2 figs. [? 1946].

When chestnut canker caused by *Endothia parasitica* was first reported in Italy [*R.A.M.*, xxvi, p. 85], a survey disclosed that the disease was widespread in

the provinces of Genoa and Alessandria, and in the spring of 1940 was reported from Friuli. By January, 1943, the affected area was gradually enlarging, while isolated centres of infection had also been found in the province of Savona and in the eastern and western parts of the province of Genoa; about 19 communes [in Udine] were involved, and a new centre of infection was found in the commune of Baiano in the province of Avellino, where about 400 ha. were attacked. In view of the extensive area affected it is feared that the disease may in time attack chestnuts in all parts of Italy.

The author reviews the history of American investigations into the disease and states that his own researches on the biology of *E. parasitica* confirm the results obtained by other workers. He deprecates any too pessimistic a view of the situation and points out that the Italian chestnut (*C[astanea] sativa*) is a different species from the American (*C. dentata*). In Italy the problem of control falls into two parts: (1) the reconstruction of the affected groves and those in immediate proximity to them, and (2) the protection of healthy groves situated at a remote distance from any permanently affected area. It is planned to plant numerous varieties of the Italian chestnut in affected areas in order to study their resistance to the parasite with a view to the development of resistant varieties. This will take at least ten years. At the same time, attempts will be made to arrest the spread of the disease. Wherever possible 'protection barriers' will be made round the infected areas, and it will be forbidden to remove any chestnut wood from localities officially declared infected.

Biraghi (A.). **Una gravissima minaccia per i nostri castagneti: il 'cancro della corteccia'.** [A very serious threat to our Chestnut groves: 'bark canker'.]—*Ital. for. mont.*, ii, 1, pp. 1–9, 5 figs., 1947.

After referring to the established presence in Italy of chestnut canker due to *Endothia parasitica* [see preceding and next abstracts] and fully describing the symptoms and manner of spread of the disease, the author states that all attempts at control in Italy by removing affected parts and destroying infected trees have proved unavailing, and such methods should be resorted to only in cases where a very few trees have been attacked. The best hope of success lies in developing hybrids between *Castanea sativa* and the resistant Oriental species *C. crenata* and *C. mollissima*, small plantings of which made in infected areas near the Apennines in 1939 and 1940 have shown resistance.

Biraghi (A.). **Cancro della corteccia del Castagno.** [Bark canker of Chestnut.]—8 pp., 1 col. pl., 2 figs., Rome, R. Stazione di Patologia Vegetale, 1946. [Received February, 1948.]

After referring to the presence in Italy of Chestnut canker (*Endothia parasitica*) [see preceding abstracts], the author requests that anyone observing it shall report its presence to the authorities (without forwarding infected material). To assist in identification, a full description of the symptoms is given in semi-popular terms.

Szkolnik (M.). **Antagonistic activity of a species of Actinomyces against Ceratostomella ulmi.**—*Phytopathology*, xxxviii, 1, pp. 85–87, 1 fig., 1948.

Two *in vitro* methods, the agar-streak [*R.A.M.*, xxv, p. 130] and the two-point inoculation, were used in tests at Rutgers University, New Brunswick, New Jersey, of the antagonistic action of a species of *Actinomyces* towards a 'black line' isolate of *Ceratostomella ulmi*, the causal organism of Dutch elm disease, from Cornell University. The *Actinomyces* originated as a contaminant on agar plates and was supplied by C. M. Haenseler. An advantage of the two-point method of inoculation,

which consists in planting each organism at opposite sides of a poured plate and allowing them to approach one another, is that both can be started simultaneously yet sufficient time is provided for the *Actinomyces* to elaborate its antagonistic substance.

When the streaks of both organisms were made on the same day, definite inhibition of *C. ulmi* by *A.* sp. was apparent within the next day or two, the former making no growth within 20 to 24 mm. of the latter. Using the two-point technique, the first indication of antagonism was observed within six days, the zone of inhibition between the two organisms measuring over 20 mm., and in some cases more than 25.

Attempts to extract the antibiotic from cultures of *A.* sp. on solid, semi-solid, and liquid media have so far been unsuccessful. Occasional filtrates and crude extracts with ether exerted a degree of activity against *C. ulmi*, as measured by the cup method.

RILEY (C. G.). **Heart rot of Oaks caused by Polyporus obtusus.**—*Canad. J. Res.*, Sect. C, xxv, 5, pp. 181–184, 1 pl., 1947.

Polyporus obtusus [*R.A.M.*, xi, p. 337; xviii, p. 356], which causes a heart rot of American species of *Acer*, walnut, *Liquidambar*, beech, *Robinia*, *Pyrus*, and *Carya*, but chiefly oak, occurs in dense concentrations in widely separated localities in North America and is destructive only within these areas. The only dense local concentration known in Canada occurs at the Petawawa Forest Experiment Station, Ontario, where species of red (*Quercus borealis*), white (*Q. alba*), and bur oak (*Q. macrocarpa*) from 0·8 to 4·8 in. in diameter were infected probably through surface injuries. Some badly decayed trees showed no external symptoms. The typical white rot, surrounded by an extensive dark discoloration, advances into the sapwood and eventually kills the tree. The number of cream-coloured, bracket-like sporophores, about 2·5 to 5·0 in. broad by 1·5 to 2·5 in. thick, varies from year to year. The disease is not believed to be of great economic importance in Ontario at present.

MOORE (M. H.). **Preliminary report on Monilia fructigena and Botrytis cinerea as wound parasites of Cobnuts and Filberts.**—*Rep. E. Malling Res. Sta., 1946*, pp. 120–121, 1 pl., 1947.

In 1943 considerable losses of cobnut [*Corylus avellana*] crops in Kent were caused by *Monilia* [*Sclerotinia*] *fructigena* [*R.A.M.*, xxiii, p. 136], and although intensive spraying experiments were carried on over several seasons, the disease continued to cause serious damage. In July, 1946, experiments showed that fungicides did not prevent infection and also that spore suspensions did not increase it. Only wounding (each nut while still soft-shelled was pierced with a steel needle) caused infection; 89 out of 96 artificially wounded nuts became infected within a week and the clusters began to drop. Of 106 nuts not artificially wounded, 21 showed the disease, but on each a recent insect puncture was observed. Where a spore suspension was not added, spores were evidently present on the nuts or alighted after wounding to cause infection through the needle wound.

When the 'pith' of rotting nuts was inoculated into wounded apples, all except two developed typical brown rot and spore cushions of *S. fructigena*. One exception developed grey mould (*Botrytis cinerea*), while the other and the uninoculated remained sterile. Healthy cobnuts inoculated with both pathogens developed typical rotting.

Investigations of the primarily infected cobnuts and filberts revealed long, tangential oviposition tunnels with freshly deposited, unhatched eggs of the nut weevil (*Balaninus nucum*). The control of brown rot evidently lies in the control of insects and other wound-producing agents.

Gruenhagen (R. H.), Riker (A. J.), & Richards (C. Audrey). **Burn blight of Jack and Red Pine following spittle insect attack.**—*Phytopathology*, xxxvii, 10, pp. 757–772, 1 fig., 3 graphs, 1947.

Jack and red pine (*Pinus banksiana* and *P. resinosa*) trees affected by burn blight have been dying since 1941 in north-eastern Wisconsin and in Michigan. In 1945 there were 64 known disease centres covering some 6,500 acres in nine north-eastern counties of the former State.

Small twigs at the tops of the trees turn yellow and then brown, the discoloration progressing downwards in the branches and main stems. Feeding punctures of the spittle insect, *Aphrophora saratogensis*, were frequent on the diseased trees, and were surrounded in some cases by necrotic spots due to *Chilonectria* (*Nectria*) *cucurbitula* [*R.A.M.*, vi, p. 683], 16 different isolates of which were used in inoculations on 412 trees. The fungal lesions usually expanded, especially during the spring and summer, following the feeding of the insects from July to September and coalesced to girdle the twigs. Perithecia developed four weeks after infection. The fungus moved down the cortex of 10-ft. high susceptible trees, killing them in one to three years.

Adults of *A. saratogensis* were present from early July until the onset of frosts, and *C. cucurbitula* was found on every one of 85 examined by cultural technique. When the insects were placed in a cage, the burn blight developed on the trees they attacked. In nature, moreover, the symptoms commonly appeared round the feeding punctures. These observations are interpreted as indicating that these adults not only carried the pathogen from infected to healthy trees, but also weakened the twigs in such a way as to afford it easy ingress. Vigorous growth appeared to be relatively resistant both to inoculation by the insects themselves and to infection by spore suspensions through needle punctures.

The formation of secondary ascospores by the pathogen places it in the genus *Chilonectria*, though its external aspect is that of a true *Nectria*. Owing to their abundance these ascospores simulate a granular mass which is liable to misinterpretation. This is believed to be the first record of the fungus in association with a serious disease. Control of the disease will depend on that of the *A. saratogensis*, but selection of suitable planting sites and interplanting with non-susceptible trees should mitigate the attacks of the insect.

Siggers (P. V.). **Temperature requirements for germination of spores of Cronartium fusiforme.**—*Phytopathology*, xxxvii, 12, pp. 855–864, 1 fig., 1947.

The effect of temperature on the germination of four types of spores produced in the spring by *Cronartium fusiforme* [*R.A.M.*, xxiv, pp. 214, 435] was investigated in a greenhouse near Saucier, Mississippi, in 1945 and 1946. The material consisted of aecidiospores from six fusiform cankers on pines (*Pinus caribaea* and *P. taeda*) in south-eastern Mississippi and from *P. rigida* in North Carolina; uredospores obtained by the inoculation of oak (*Quercus nigra* and *Q. phellos*) seedlings in Mississippi; teleutospores formed on *Q. nigra* inoculated with aecidiospores; and sporidia produced by the teleutospores. The spores were germinated in distilled water mounts or in a saturated atmosphere.

The minimum period required for the inception of germination was found to be $2\frac{1}{4}$ hours at 23° C. for aecidiospores, under one hour at 25° for uredospores, nine hours at 17° to 23° for teleutospores, and $2\frac{1}{4}$ at 28° to 29° for sporidia. The germinability of the different spore lots was found to depend mainly on the age of the collection and storage conditions. Thus, the viability of aecidiospores stored below 10° remained at a high level for a maximum of 76 days, while uredospores kept under similar conditions were successfully used for inoculation 223 days after collection. Teleutospores germinated after exposure to fluctuating greenhouse temperatures

from 6th March to 8th May, 1945, but attempts to store sporidia were unsuccessful. The minimum, optimum, and maximum temperatures for aecidiospore germination were found to be slightly below 11°, 21°, and 29°, respectively, the corresponding figures for uredospores being a little above 8°, 18°, and 29°, for teleutospores 15°, probably about 21° but not definitely ascertained, and 26°, and for sporidia 13° to 14°, 22°, and just above 29°, respectively.

Control measures in forest tree nurseries where *C. fusiforme* has consistently caused loss of planting stock should be timed with reference to periods of high infection risk. In nature, sporidia develop in profusion if a protracted dry spell in April or May is followed by rain for a day or longer, and the application of a protective spray one day before precipitation is expected should prove more effective than a treatment three or four days earlier. Since sporidia do not germinate at 13°, and hence infection of pine seedlings does not occur, spraying could be deferred as long as the daily mean temperature does not exceed this point.

Tippo (O.), Walter (J. M.), Smucker (S. J.), & Spackman (W.). **The effectiveness of certain wood preservatives in preventing the spread of decay in wooden ships.** —*Lloydia*, x, 3, pp. 175–208, 8 figs., 1947.

This investigation, conducted at various research centres in the United States, was made to determine the effectiveness of replacing decayed timber of wooden boats [*R.A.M.*, xxvi, p. 572] with new wood, treated or untreated, and of preservatives in preventing the spread of decay from infected to sound ship timbers. Southern yellow pine [*Pinus palustris*] test panels were made up of three blocks, one artificially infected with a wood-decaying fungus *Poria xantha* [loc. cit.], screwed together so that the fungus could enter the end grain of one uninoculated block and the side grain of the other. Several sets of blocks were treated in preliminary experiments with celcure (a proprietary compound containing 6 per cent. each of copper sulphate and sodium bichromate in aqueous acetic acid) [ibid., xxii, pp. 46, 464], copper ammonium naphthenate, copper naphthenate, 5 per cent. pentachlorophenol, creosote, BSE, or 0·5 per cent. phenyl mercury oleate [ibid., xxvi, p. 139] by a quick dip method. In the final test only the last two and chlorinated phenols were used. In one set the inoculum blocks of panels were brushed with the preservative while the other two blocks were steeped for four hours in hot preservative (140° F.) and left to cool overnight in it; in a second set all the blocks were brushed with the preservative, in a third only the inoculum blocks were brushed, while a fourth set remained entirely untreated. After exposure in a humidity chamber at 90 to 94 per cent. humidity and 75° to 85° F. for 19 months, during which time fresh inoculum blocks replaced the old after each six-month period, the disassembled blocks were examined for decay.

The results showed that the chlorinated phenols and phenyl mercury oleate (used at 0·5 per cent. and ineffective below 0·3) were superior to copper naphthenate in preventing the spread of *P. xantha* from infected to sound wood. Preservative applied by the hot and cold bath method gave better protection than a single coating by brush. The following steps are recommended in repairing ships. All rotted wood and that up to about 2 ft. beyond the visibly infected area and the paintwork from the surrounding wood to a distance of several feet should be removed. The remaining wood should be coated with a preservative such as chlorinated phenols and the decayed replaced by seasoned, treated, decay-resistant heartwood of Douglas fir [*Pseudotsuga taxifolia*], southern yellow pine, or white oak [*Quercus alba*]. Any water source contributing to the decay should be located and eliminated. In the construction of wooden vessels all wooden parts requiring preservation, except the outer planking below the water-line, should be treated with chlorophenols.

'OSTER (H. H.) & PINCKARD (J. A.). **Control of Cabbage downy mildew with benzene vapor.**—*Phytopathology*, xxxvii, 12, pp. 896–911, 3 figs., 1947.

A tabulated account is given of three years' (1943 to 1946) trials at the Mississippi Agricultural Experiment Station on the control of cabbage downy mildew (*Peronospora parasitica*) with benzene vapour, a preliminary note on which has already appeared [*R.A.M.*, xxiv, p. 259; cf. also ibid., xxvi, p. 574].

Humidity was found to be a critical factor in the sporulation of the fungus [ibid., xxv, p. 244], which occurred within a wide temperature range (35° to 80° F.) provided high humidity, approaching a saturated atmosphere, prevailed during the night. The results of repeated experiments indicated that benzene is effective at the rate of 50 c.c. per sq. yd. when applied on five consecutive nights per week under a wet muslin cover of 48×44 thread count, the treatments beginning in advance of sporulation and continuing to within a few weeks of field transplanting. After the development of the third or fourth true leaf a concentration of 25 c.c. benzene per sq. yd. sufficed to arrest sporulation for the rest of the vaporization period. Promising results were also given by the application of 25 c.c. benzene on five successive nights per week under a 64×64 dry cover. The cost of the treatments was estimated at about 30 cents per 1,000 plants.

POUND (G. S.). **Reactions of Cabbage varieties to mosaic viruses.**—*J. agric. Res.*, lxxv, 1, pp. 19–30, 1947.

Extensive field tests were carried out from 1943 to 1945 [*R.A.M.*, xxvi, p. 519] to ascertain the relative susceptibility to mosaic of the more common commercial cabbage varieties which are grown for seed in the Puget Sound area of Washington State. In 1943–4 naturally affected plants in the field were examined. In 1944 varieties were transplanted into paired rows, one being inoculated with a mixture of viruses A (a strain of turnip virus 1 [turnip mosaic virus]) and B (a strain of cauliflower virus 1 [cauliflower mosaic virus: ibid., xxv, p. 243]) from Wisconsin. In 1945 inoculations were carried out with viruses A and B from Wisconsin, viruses A and B isolated in Washington, and with a mixture of Wisconsin virus B and California black ring virus (another strain of turnip mosaic virus) [ibid. xvii, p. 151]. At least two disease ratings were made each year between the autumn and the following seed harvest. The least susceptible varieties, which react with general chlorosis, vein-clearing, slight leaf distortion, and slight mottling, were Wisconsin All Seasons, Stein's Early Flat Dutch, All Head Select, Succession, and Globe. The intermediately susceptible group comprised Golden Acre, Resistant Detroit, Copenhagen Market, Marion Market, Midseason Market, Glory of Enkhuizen, Early Round Dutch, Early Jersey Wakefield, Charleston Wakefield, All Head Early, and Premium Late Flat Dutch. All round-headed varieties of this group show severe or very severe yellow mottling, severe leaf distortion and stunting, and necrosis. The last four varieties are especially good indicators of virus B. The most susceptible varieties include Wisconsin Hollander, Bugner, Penn State Ballhead, Ferry's Hollander Wisconsin Ballhead, and Improved Wisconsin Ballhead. The first three of this group do not show severe symptoms until late in the season.

When over-all severity is considered the varieties possess an equal relative susceptibility whether virus A or black ring virus is combined with virus B to produce mosaic disease. The black ring virus, however, causes more necrosis. These investigations showed that the viruses causing mosaic in the Puget Sound area are identical with those occurring in the Midwest.

Mosaic symptoms reacted to changes in air temperature from late summer to the following spring at Puget Sound as in Wisconsin [ibid., xxv, p. 243], symptoms of virus B being most pronounced at low temperatures and those of virus A at high ones. By June, virus A symptoms were predominant, the plants showing severe mottling, necrosis, and defoliation.

Pound (G. S.). **Beet mosaic in the Pacific Northwest.**—*J. agric. Res.*, lxxv, 1, pp. 31–41, 3 figs., 1947.

Beet seed crops in the Puget Sound district of Washington State have been seriously affected by a mosaic virus which, upon examination of the occurrence, host range (a list of hosts with symptoms is given), symptoms, and properties, is thought to be identical with the sugar beet mosaic virus occurring in other parts of the United States [*R.A.M.*, x, p. 574; xxvii, p. 54] but distinct from the beet mosaic virus in Europe [ibid., xxii, p. 124], having a more restricted host range and different physical properties.

On sugar beet leaves the symptoms appear as chlorotic mottling or as yellow rings with dark green centres, the spots becoming zonate and frequently necrotic with age. The leaves of garden beet show vein-clearing, followed by small chlorotic rings with pigmented centres, or else uniform chlorotic spots with pigmented peripheries, while in some cases ring-spotting may be entirely absent. Often young leaves present an irregularly etched appearance along the veins. Spinach is commonly infected with a strain of turnip virus 1 [turnip mosaic virus] and a strain of cucumber virus 1 [cucumber mosaic virus]. The symptoms produced by each of these three viruses on spinach in the field may easily be confused.

Mechanical inoculations with the sugar-beet mosaic virus infected all chenopodiaceous plants tested. The primary natural hosts are considered to be beet, spinach, *Zinnia elegans*, and *Amaranthus retroflexus*. *Stellaria media* and *Capsella bursa-pastoris* were susceptible and *Verbena hybrida* and cultivated pansy were symptomless carriers. Transmission experiments showed that the black bean (*Aphis fabae*) and green peach (*Myzus persicae*) aphids are vectors of the virus. Although transmission was also obtained with the cabbage aphid (*Brevicoryne brassicae*) this insect is not believed to be a common vector. The virus was transmitted readily by mechanical means with or without carborundum as an abrasive, and was recovered from semi-mature but not from mature seed. The virus was inactivated when aged *in vitro* for 72 hours at 20° C., when diluted 1 to 2,000, and when heated for ten minutes at 61° [ibid., xii, p. 674]. Practical control of the disease in the Puget Sound area, where losses have sometimes reached 50 per cent. of the garden beet seed, was obtained by growing steckling beds as far as possible from diseased seed fields.

Weimer (J. L.). **Resistance of Lathyrus spp. and Pisum spp. to Ascochyta pinodella and Mycosphaerella pinodes.**—*J. agric. Res.*, lxxv, 5–6, pp. 181–190, 3 figs., 1947.

As a result of ten years' trials at the Georgia Agricultural Experiment Station with 160 varieties and strains of field and garden peas [*R.A.M.*, xix, p. 382], Austrian Winter still proved to have the greatest degree of resistance to *Ascochyta pinodella* and *Mycosphaerella pinodes* [ibid., xxvi, p. 91]. *Pisum elatius* and a probably closely related wild Turkish species also showed some resistance under the conditions of the experiments, although resistance was not apparently transmitted to the progeny of crosses between them. A strain of *Lathyrus hirsutus* was immune from attacks by the fungi studied, *L. sativus* was resistant, and *L. tingitanus* moderately so.

McClean (A. P. D.) & Klesser (P. J.). **Mottle-leaf disease of the Sweet Potato.**—*Fmg S. Afr.*, xxii, 260, pp. 897–900, 5 figs., 1947.

During 1946 a disease of the sweet potato, believed to be the same as that already reported from East Africa [*R.A.M.*, xxvi, p. 145] and the United States [ibid., xxv, p. 93], was observed for the first time in the Nelspruit, Pretoria, Brits, and Rustenburg districts of the Transvaal. Half the cuttings from diseased plants died and

he rest were severely stunted, growing to only one-third of the height of healthy plants. A characteristic symptom of both naturally and artificially infected plants is a network mottling of the mature leaves due to a yellowing along the course of the veins. In some naturally infected plants a mosaic mottling of mingled light and dark green areas without any yellowing was observed. Affected plants are generally pale in colour, with small, closely grouped leaves. The characteristic mottle was transmitted to healthy plants by grafting diseased shoots on to them. The disease is thought to be of virus origin and may multiply quickly in the field unless care is taken that stem and root cuttings are procured only from healthy plants.

Rader (W. E.), Fitzpatrick (H. F.), & Hildebrand (E. M.). **A seed-borne virus of Muskmelon.**—*Phytopathology*, xxxvii, 11, pp. 809–816, 2 figs., 1947.

A seed-borne mosaic virus, which has been affecting muskmelons in New York since 1936, differs from the cucumber mosaic virus in its more restricted host range and much higher percentage of seed transmission, and cannot be identified with any of the other viruses already reported on cucurbits, though it may possibly be the same as Mahoney's Michigan melon mosaic [*R.A.M.*, xiv, p. 811]. However, in the absence of specific information on the characters of the latter, the New York muskmelon mosaic virus is herein described as new and the name *Marmor melonis* n.sp. proposed, according to Holmes's classification [ibid., xix, p. 229].

The symptoms of the New York virus appear on the first leaves of seedling muskmelons about a fortnight after planting in the greenhouse. The first affected leaf usually exhibits a conspicuous veinbanding in the form of a narrow dark green border parallel with each of the main veins. With few exceptions, e.g., in the highly susceptible Queen of Colorado variety, the leaves produced later do not show this feature, being mottled, without relation to the veins, in a coarse pattern of light and dark green ranging from a dark green marginal stippling to a barely discernible mosaic. In some of the leaves the veins protrude beyond the edge, imparting a peculiar serrated appearance. In severe cases the foliar malformations assume the form of elongation and curling, while in milder ones the leaves have a smoothly outlined, cordate pattern.

In experiments on melon, 100 per cent. transmission was regularly secured by rubbing the leaves of healthy plants with cheesecloth swabs saturated in infective juice, the symptoms appearing within 10 to 13 days after inoculation. The virus was recovered from all parts of the plants. Transmission of the virus through the seed was regularly observed before studies were initiated. Virus symptoms developed on 43, 24, and 12 per cent., respectively, of the plants arising from three lots of two-year-old seed from three diseased plants. Two lots of seed harvested in 1941 with 93·5 and 27·9 per cent. mosaic, respectively, three years later produced 2·6 and 6·4 per cent. diseased plants. In small-scale greenhouse tests the New York muskmelon mosaic virus was readily transmitted through seeds of melon, *Cucurbita moschata*, *Cucumis flexuosus*, and Summer Crookneck squash, but not through cucumber seeds.

Positive results were obtained in inoculation experiments on the Hubbard, Buttercup, and Golden Delicious winter squash varieties, *Cucurbita moschata* (Long Island Cheese), Summer Crookneck, Table Queen, and Zucchini summer squash, West India gherkin (*Cucumis anguira*), *C. flexuosus*, a number of melon (*C. melo* var. *reticulatus*) varieties, *C. melo* vars. *chito*, *conomon*, and *inodorus*, and National Pickle cucumber. All these plants showed mottling of the younger leaves, except the last-named, in which the symptoms were very faint or masked. Plants showing New York muskmelon mosaic symptoms readily contracted infection by the cucumber mosaic virus, which took the form of foliar stunting and rosetting of the terminal growths. The only symptoms in the diseased progeny from the

seed of these plants containing both viruses were those of the typical muskmelon mosaic.

The muskmelon mosaic virus was inactivated by ten minutes' exposure to a temperature of 60° to 62° C.: this being also approximately the thermal death point of the seed, treatments with water of sufficient heat to destroy the virus would obviously kill the embryo at the same time. The virus resisted ageing for upwards of 74 hours, with a maximum of 250, in *in vitro* tests at laboratory temperatures. The sap from diseased plants was still infective after 72 hours' drying on glass slides (298 hours in one test), but not after three months in dried muskmelon leaves. The sap from young mosaic leaves remained infective in dilutions up to 1 in 2,500 but not 1 in 3,000.

Eicke (Ruth) & Bode (O.). **Zur Betrachtung von Virussymptomen im ultravioletten Licht.** [On the observation of virus symptoms in ultra-violet light.] —*Arch. ges. Virusforsch.*, iii, 6, pp. 327–334, 7 figs., 1947.

Descriptive notes are given on the appearance in ultra-violet light of various strains of potato X and Y and tobacco mosaic, ring spot, and necrosis viruses on tobacco leaves. Although the symptoms on the irradiated specimens differed greatly from those on comparable material examined in daylight, it was found impossible to utilize the variations for diagnostic purposes, since more than one species of virus presented a similar picture in ultra-violet light.

A comment of this paper by E. Köhler is appended (pp. 334–335).

Rich (S.). **A rapid stain method for detecting certain virus inclusions.**—*Stain Tech.*, xxiii, 1, pp. 19–20, 1948.

The trypan blue method for the detection of crystalline inclusions, e.g., those of *Phaseolus* virus 2 [bean yellow mosaic virus] and certain lily viruses [*R.A.M.*, xxi, p. 61], is greatly facilitated by a pre-stain treatment with a solution consisting of 5 ml. diethyl ether and 10 ml. ethyl alcohol diluted to 100 ml. with physiological saline solution. Maceration of the plant material in 0·05 per cent. trypan blue solution also gives satisfactory results.

Stations fédérales d'essais viticoles, arboricoles et de chimie agricole, à Lausanne et à Pully. Rapport d'activité 1946. [Report for 1946 on the work of the Federal Viticultural, Arboricultural, and Agricultural Chemistry Stations at Lausanne and Pully.]—*Annu. agric. Suisse*, xlviii, 8–9, pp. 701–792, 1947.

The following items are contributed by M. Staehelin and his assistant, W. Wurgler, in the section of physiology and plant protection (pp. 714–729) [cf. *R.A.M.*, xxvi, p. 185]. For the control of vine downy mildew (*Plasmopara viticola*), which appeared late, Bordeaux mixture (2 per cent.) was more effective than the less tenacious copper oxychlorides and copper oxides tested [ibid., xxvi, p. 527], its coefficients of efficacy (representing the reduction in the number of infected leaves secured by the treatment) in three experimental localities being assessed at 96·4, 92·9, and 99·4 per cent., respectively, corresponding to a loss of 0·1 per cent. of the crop.

Similar observations were made in connexion with the control of 'rotbrenner' (*Pseudopeziza tracheiphila*) [loc. cit.], three or more applications of 2 per cent. Bordeaux mixture conferring adequate protection, whereas the copper oxychloride and copper oxide treatments and Bordeaux at 3 per cent. were less successful. The early sprays (25th April and 3rd May) were shown to be of crucial importance.

Grey mould (*Botrytis cinerea*) was effectively combated by the late (29th July) combined treatment against downy mildew and insect pests with 2 per cent. Bordeaux mixture plus 1 per cent. nirosan.

The apple scab (*Venturia inaequalis*) experiments were designed to settle certain problems of topical interest. The combined insecticidal and fungicidal treatment applied to dormant Beauty of Boskoop trees on 21st March, consisting of 2 per cent. copper oxychloride plus 1 per cent. DDT, 2 per cent. dinitrocresol plus 2 per cent. copper oxychloride, or 4 per cent. carbolineum plus 2 per cent. copper oxychloride, proved equally effective with the pre-blossom (3rd April) spray of 1·5 per cent. lime-sulphur plus 0·5 per cent. copper oxychloride, the application of which presents considerable technical difficulties. Opinions differ as to the relative value of copper carbonate and copper oxychloride as adjuncts to lime-sulphur in the post-blossom sprays. In tests on the Canada Reinette, Transparente de Croncels, and Gravenstein varieties in three localities, copper carbonate (0·1 and 0·15 per cent.) proved uniformly superior to copper oxychloride as a protectant (same concentrations).

In the Swiss climate apple mildew (*Podosphaera leucotricha*) [ibid., xxiv, p. 107; xxv, p. 153] appears to overwinter in the form of perithecia, and as mycelium in the buds [cf. ibid., xxiv, p. 193]. Should only the tips of the branches be involved the focus of infection will be eliminated by winter pruning, but the mycelium frequently descends towards the base and survives as a source of primary contamination for the next season. Freshly precipitated iron sulphate (0·8 per cent.) was found to be superior to wettable sulphur at the same strength as an adjuvant to 2 per cent. lime-sulphur in the spray schedule. Thus, in one series of tests comprising three treatments on Belle of Boskoop, the former combination reduced the incidence of mildew from 46 to 9·4 and the latter to 16 per cent., while the corresponding figures in four-spray schedule were from 36 to 7·9 and 22·5 per cent., respectively.

Most of the copper-containing products used for vine downy mildew control were also included in parallel tests against celery blight (*Septoria apii*) [ibid., xxv, p. 536]. The efficiency ratings for the two diseases were of quite a different order, as shown by the following figures representing the percentages of leaves destroyed by the two pathogens: (1) vine downy mildew, control 47·1, copper oxide 5·1, copper oxychloride paste 4·7, copper oxychloride dust 3·1, Bordeaux mixture 1 and 2 per cent. 2·8 and 1·7, respectively; (2) celery blight, control 58·5, copper oxychloride dust 20·6, 1 per cent. Bordeaux and copper oxychloride paste 16·2, copper oxide 7·5, and 2 per cent. Bordeaux 4·6.

C. Fleury, in charge of the section of bacteriology (pp. 736–741), briefly reports the results of an investigation on an 'off' flavour of wine attributable in all probability to chemical alterations in the grapes resultant on the metabolic activities of the deeply penetrating grey mould [*Botrytis cinerea*: ibid., xxvi, p. 527]. He further records the presence in mushroom beds of the 'mummy disease', hitherto unknown in Switzerland. The interior of the misshapen, rotting sporophores is very often occupied by small, blackish cavities replete with bacteria, probably *Pseudomonas* [cf. ibid., xxiii, p. 126], which were, however, merely secondary and gave negative results in inoculation experiments.

The above-mentioned differences in tenacity between Bordeaux mixture and other copper-containing fungicides [cf. ibid., xxvi, p. 526; xxvii, p. 75] are more fully discussed by G. Trivelli, head of the section of anti-parasitic products. By means of an ultra-refined technique, the deposit of copper oxide Sandoz remaining on vine leaves was shown to be only 48 per cent. of the residue from 1 per cent. Bordeaux mixture, while the action of 20 mm. rain caused a further reduction to 41 per cent. On the basis of a series of laboratory tests, the amounts of copper lost by weathering were computed at 1·37 and 15 per cent., respectively, of the initial deposits of Bordeaux and copper oxide. These differences were reflected in the results of vineyard trials, in which the residue of copper on foliage sprayed for the first time with 0·5 per cent. copper oxide amounted, on an average of five analyses, to only 56 per

cent. of that left by 1 per cent. Bordeaux. Successive analysis of leaf samples from the second to the fifth applications revealed a further reduction to 52 per cent., the effect of weathering, for copper oxide as compared with Bordeaux.

In a further series of tests the relative adhesiveness of 2 per cent. Bordeaux mixtures containing 300, 400, and 600 gm. lime per kg. copper sulphate was determined as 82·3 (pH 7), 95·3 (10·8), and 105·2 (11·75), respectively, compared with 100 (11·5) for the standard formula (containing 500 gm.). It will be noted that adhesiveness improved parallel with increasing quantities of lime and rising pH.

An account is given by E. Bovay of observations and experiments in the section of physiological chemistry (pp. 777–788) on the nutrient deficiencies of fruit trees and vines.

Săvulescu (T.) et al. **Starea fitosanitaria in România in ânul 1937–1938, 1938–1939, 1939–1940, 1940–1941, 1941–1942, 1942–1943, 1943–1944.** [The phytosanitary situation in Rumania in 1937–1938, 1938–1939, 1939–1940, 1940–1941, 1941–1942, 1942–1943, 1943–1944.]—*Publ. Inst. Cerc. agron. României* 62, 98 pp., 1940; 72, 106 pp., 4 figs., 1 map, 1941; 76, 155 pp., 10 figs., 1 map, 1942; 82, 123 pp., 11 figs., 1 map, 1943; 92, 118 pp., 12 figs., 1944; 96, 77 pp., 5 figs., 1947; 97, 68 pp., 4 figs., 1947. [French translations. Received April, 1948.]

The following are among the many items of interest in these reports [cf. *R.A.M.*, xvii, p. 655], in the compilation of which assistance was given by C. Sandu-Ville, A[lice] Aronescu-Săvulescu, A. Hulea, A. Hulpoi, V[era] Bontea, A. Racoviță, A. Marin, Ang[ela] Racoviță, and A. Papadopol. *Pseudomonas* [*Xanthomonas vesicatoria* was observed on chilli [ibid., xxii, pp. 52, 237] in 1937–8 for the first time in Rumania, where the only previous record of the pathogen was on tomato. A severe outbreak of *Sphaerotheca mors-uvae* occurred on gooseberries at Miercurea Ciucului during the same year, while *Didymella applanata* caused severe loss in a plantation of raspberries at Pantelimon. *Nectria galligena* was widespread on cherry at Râmnicu Vâlcea.

In July, 1939, tomato leaf mould (*Cladosporium fulvum*) made its first appearance in the country in the glasshouses of the Horticultural College at Nucet, Department of Dambovitza. During the same season snapdragon [*Antirrhinum majus*] rust (*Puccinia antirrhini*) [ibid., xviii, p. 740] developed with extraordinary intensity, destroying entire plantings in various districts.

Botrytis tulipae occurred for the first time in Rumania on glasshouse tulips at Săftica in 1940. The Telescopium and Albino varieties sustained the heaviest damage, William Pitt, [Rose] Copeland, and Zenita being somewhat more resistant, and Baronne de la Tonnaye extremely so. Control may be effected by vaporization of the houses or soil sterilization with formalin [ibid., xv, p. 509]. Other new records for 1940 were *Cumminsiella sanguinea* on barberry [ibid., xx, p. 495] and *Botrytis cinerea* on peach.

A summary of the report on plant diseases in Rumania in 1941 has already been noticed from another source [ibid., xxi, p. 404].

Pseudopeziza medicaginis was observed on lucerne in one locality in 1941–2 and *Podosphaera leucotricha* was prevalent on apple in the same year. Potato wart (*Synchytrium endobioticum*) developed with great intensity [ibid., xxv, p. 439] in the department of Hunedoara, where the incidence of infection ranged from 50 to 100 per cent. Other centres of infection were found in the department of Făgăras [ibid., x, p. 692] and in the Ceremus Valley, Bukovina, where the disease was introduced, probably from Poland, during the Russian occupation in 1940. Lettuces were attacked by *Sclerotinia libertiana* [*S. sclerotiorum*] for the first time in Rumania in 1942. *Bremia lactucae* also occurred on the same host. Other new records for the year have already been noted [ibid., xxv, p. 439].

Bacterium marginatum, not hitherto reported in the country, was observed on *Gladiolus* in 1943.

Plant diseases. Notes contributed by the Biological Branch. Downy mildew (blue mould) of Tobacco and spotted wilt of Tomatoes.—*Agric. Gaz. N.S.W.*, lviii, 11, pp. 571–574, 5 figs., 1947.

Control measures against tobacco downy mildew (*Peronospora tabacina*) [*R.A.M.*, xxvi, p. 268; xxvii, p. 175] include the compulsory destruction of all plants after harvest, the eradication of volunteer and indigenous wild tobacco plants, the selection of sunny, well-drained, uninfected seed-bed sites, and the planting of disease-free seed. The use of fertile soil promotes vigorous seedling growth and prior to seeding the soil should be sterilized by steaming or saturation with formalin (1 gal. to 50 gals. water). Overcrowding should be avoided and the seedlings gradually hardened. Mildewed plants should be destroyed on sight. Shortly before emergence and until they are ready for transplanting, seedlings should be exposed every night to benzol [benzene] fumes.

Spotted wilt of tomatoes [ibid., xxvii, p. 222] can be reduced by half where the rate of infection on unsprayed plots is not expected to exceed 50 per cent., by a spray consisting of 1 oz. tartar emetic, 4 oz. sugar, and 4 gals. water. In cases where losses on unsprayed plants are expected to be less than 70 to 80 per cent., satisfactory control is obtained by multiple planting, in conjunction with the spray, two or three plants being placed to one stake and those contracting the disease removed.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz., N.S.W.*, lix, 1, pp. 32–36, 46, 1948.

Brief notes are given on the symptoms and control of the following diseases of stocks [*Matthiola incana*] in New South Wales: black rot (*Xanthomonas incanae*) [*R.A.M.*, xxii, p. 25; xxiii, p. 4], mosaic [cf. ibid., xvi, p. 322; xviii, p. 459], crown rot (*Rhizoctonia* [*Corticium*] *solani*) [ibid., xxii, p. 163], blight (*Sclerotinia sclerotiorum*), root rot (*Pythium* sp.), and leaf spots [unspecified].

Black rot is still the most serious stock disease in the State; in some seasons it causes almost complete failure of the early crop. Most of the infection can be eliminated by tying 2 oz. lots of seed very loosely in cheesecloth squares and submerging them in hot water at 56° to 56·5° C. for 10 minutes, after which they should be plunged into cool water and laid out to dry. The treatment may reduce the germination of weak seed by 20 to 30 per cent. The seed should be kept away from all sources of reinfection and sown thinly in well-drained seed-beds. Mosaic is usually prevalent. By reducing the market value of the flowers it is sometimes responsible for considerable financial loss. Affected plants should be removed promptly and destroyed; insecticidal treatment should be adopted; weeds should be eliminated; and if the crop becomes infected it should be burnt or ploughed in, no further stocks being planted until three months have elapsed. *S. sclerotiorum* is sometimes serious in cool wet weather in late autumn and winter. Affected plants should be burnt. Wide spacing with good ventilation and drainage are recommended. Against *Pythium* root rot it is advised that stocks should be planted in well-drained soil; if the disease appears, the rotation should be lengthened, and beans should not be included.

New records for 1947 include *Heteropatella antirrhini* on *Antirrhinum majus* [ibid., xxv, p. 330], *Phytophthora cinnamomi* [ibid., xxvi, pp. 68, 399] on sweet chestnut and other hosts, *Stagonospora curtisii* [ibid., xxv, p. 330] on *Hippeastrum vittatum*, *Phoma citricarpa* on holly (*Ilex aquifolium*), *S. curtisii* and *Armillaria mellea* on *Narcissus pseudo-narcissus*, and *Fabraea maculata* [ibid., xxvi, pp. 285, 330] on *Raphiolepis indica*.

Williams (R. O.). **Annual Report of the Department of Agriculture, Zanzibar Protectorate, for the year ended 31st December, 1946.**—45 pp., 1 graph, 1947.

During the period under review indications were forthcoming of an increase in the incidence of 'sudden death' of cloves in Zanzibar [*R.A.M.*, xxvi, p. 45] but no perceptible change in the situation occurred in Pemba.

Hemileia vastatrix was detected, for the first time in Zanzibar, causing defoliation of Liberica coffee in blocks suffering from the effects of drought in the early part of the year.

Hampton (J. E.). **Cure of crown gall with antibiotics.**—Abs. in *Phytopathology*, xxxviii, 1, pp. 11–12, 1948.

Streptomycin and penicillin, both commercial and locally produced crude, have proved effective in the control of crown gall [*Bacterium tumefaciens*] on *Bryophyllum pinnatum* [*R.A.M.*, xxiv, p. 406], tomato, *Ricinus communis*, greengage plum, *Prunus salicina*, Bartlett pear, Duke cherry, *Ligustrum lucidum*, and other plants. The galls, which were either aerial or subaerial, soft or hard, and situated on the stems, tap-roots, and secondary roots, were usually treated by the application of a cotton-wool pad saturated with the antibiotic, but immersion of the diseased roots and hypodermic injections have also been practised. It is suggested that the use of antibiotics against crown gall should prove particularly valuable in nurseries.

Mudd (S.). **Submicroscopic structure of the bacterial cell, as shown by the electron microscope.**—*Nature, Lond.*, clxi, 4087, pp. 302–303, 1948.

In this contribution to a symposium on electron microscopy at the Nobel Institute of Physics, Stockholm, the structure of the bacterial cell as shown by electron micrographs is described. Flagella, when present, appear to arise from the protoplast and pass through the cell wall [*R.A.M.*, xxvii, p. 225]. The combination of bacterial antigens with antibodies was observed directly. Specific antibodies combine with somatic and flagellar antigens of non-capsulated bacteria, forming surface deposits on the cell wall and flagella.

De Ropp (R. S.). **The growth-promoting action of bacteria-free crown-gall tumor tissue.**—*Bull. Torrey bot. Cl.*, lxxv, 1, pp. 45–50, 1948.

Further investigations into the growth-promoting substances produced by bacteria-free crown-gall tissue [*R.A.M.*, xxvi, p. 442] indicate that the undetermined substance inducing growth in excised fragments of sunflower stem tissue does not diffuse into agar and is absent in its active form from extracts of tumour tissue.

Elrod (E. P.) & Braun (A. C.). **Serological studies of the genus Xanthomonas. III. The Xanthomonas vasculorum and Xanthomonas phaseoli groups; the intermediate position of Xanthomonas campestris.**—*J. Bact.*, liv, 3, pp. 349–357, 1947.

Continuing their studies on *Xanthomonas* [*R.A.M.*, xxvi, p. 382], the authors deal with three more immunological divisions, the *X. vasculorum*, *X. phaseoli*, and *X. campestris* groups. The nature of the intermediate role of *X. campestris* and *X. barbareae* and the members of the *vasculorum* and *phaseoli* groups were compared by means of agglutinin absorption.

Random sampling of absorbing combinations not having produced specific sera in the *X. vasculorum* group, reciprocal absorptions were conducted between all eight organisms (*X. vesicatoria* and its var. *raphani*, *X. hederae*, *X. incanae*, *X. papavericola*, *X. campestris* var. *armoraciae*, *X. vasculorum*, and *X. taraxaci*), with

a few exceptions concerning *X. incanae*. In no instance did these mirror absorptions indicate that any two of these species were serologically identical, neither was it possible to produce a specific antiserum for the homologous organisms by absorption with any one of the heterologous types. The patterns produced by these absorptions were varied, indicating the presence of a multitude of group-specific factors. *X. campestris* var. *armoraciae* showed closer immunological affinities with the *X. vasculorum* group than with *X. campestris*.

Absorption of antisera of the organisms in the *X. phaseoli* group (*X. geranii*, *X. pelargonii*, *X. phaseoli*, *X. malvacearum*, and *X. phaseoli* var. *fuscans*) by any heterologous culture of the group left only species-specific factors. It may be assumed that the group-specific components are identical and uniform in distribution. *X. geranii* and *X. pelargonii* were serologically identical; they reacted identically in all absorbing combinations and were also alike as shown by mirror absorption with their respective immune serums.

The intermediate position of *X. campestris* and *X. barbareae* between the two preceding groups is unique and the similarity of reaction manifest between the two species led to the carrying-out of mirror absorption tests between them. This resulted in complete reduction of activity in each case, indicating the serological identity of the two organisms, the only difference between them being their ability to infect different hosts.

Absorption of *X. campestris* antiserum by any member of the *X. vasculorum* division removed all the agglutinins for this group, while reducing the components peculiar to *X. campestris* and not removing the factors active against the *X. phaseoli* group. Similarly, absorption of *X. campestris* immune serum by members of the *phaseoli* group removed antibodies active for the latter organisms, but failed to obliterate activity for *X. campestris* and the *vasculorum* group. Multiple absorption with *X. geranii* and *X. campestris* var. *armoraciae* left *X. campestris* antiserum only specific agglutinins. The last-named is characterized by a factor common to the *phaseoli* group and one common to the *vasculorum* group, in addition to species-specific components.

Thus it appears that many well-recognized *X.* spp. based on known host range are distinct immunologically; but the antigenic properties of an organism are not necessarily correlated with its ability to infect given host species.

Smith (L.). **The effect of chaff of cereals on germination of seeds and on the growth of mold.**—*J. Amer. Soc. Agron.*, xl, 1, pp. 32–44, 1 fig., 1948.

In connexion with an inquiry at the Washington Agricultural Experiment Station into the existence in seed coverings of substances tending to promote germination and growth, observations were made on the effect of chaff on the seed germination of several species and varieties of wheat, barley, and oats, and on mould growth on einkorn [*Triticum monococcum*] and barley seeds. Unshelled seeds of three stocks of einkorn and one of barley contracted substantially less mould than shelled ones; the other cereals tested were virtually free from contamination. Aqueous solutions of wheat chaff extracts were sometimes, but not consistently, effective in the inhibition of seed germination and the growth of *Rhizopus nigricans* [*R. stolonifer*] on shelled seeds.

Borlaug (N. E.) & Rupert (J.). **Leaf rust of Wheat in Mexico.**—Abs. in *Phytopathology*, xxxviii, 1, p. 3, 1948.

Wheat leaf [brown] rust (*Puccinia rubigo-vera tritici*) [*P. triticina*] has become an increasingly important factor in the production of the crop in Mexico [*R.A.M.*, xxiv, p. 222], where many varieties introduced on account of their proved resistance in other countries have been found highly susceptible to the disease. Moreover, at least one physiologic race exists in Mexico which is uncommon elsewhere and

severely attacks a wide range of varieties, including the durums. Mida and Trigo Supremo × 41–116 have been selected as the best parental material for brown rust resistance, since Newthatch and Kenya, ordinarily used when stem rust [*P. graminis*] resistance is sought, are liable to heavy infection by the Mexican races of *P. triticina*.

Storey (I. F.). **Observations on take-all and eyespot diseases of Wheat in Yorkshire.**—*Ann. appl. Biol.*, xxxiv, 4, pp. 546–550, 1 map, 1947.

Surveys carried out in Yorkshire from 1944 to 1946 on farms where wheat crops were reported to be unsatisfactory showed that both take-all (*Ophiobolus graminis*) [*R.A.M.*, xxvi, p. 232] and eyespot (*Cercosporella herpotrichoides*) [ibid., xxvi, pp. 193, 387] were present, the latter being the more serious trouble on the better lands. Both were favoured by too frequent cropping with wheat or barley. After a one-year seeds ley consisting of mixtures of clovers or grasses and clovers disease incidence was influenced by the nurse crop used to undersow the seeds and by the date when the ley was ploughed up. Oats were preferable to wheat or barley as a nurse crop, and in 1946 late ploughing greatly reduced eyespot in the following wheat crop.

To ensure the disappearance of both organisms from the soil a two or three years' ley is considered desirable.

Dungan (G. H.), Bigger (J. H.), Lang (A. L.), Koehler (B.), & Jugenheimer (R. W.). **Illinois hybrid Corn tests 1946.**—*Bull. Ill. agric. Exp. Sta.* 521, pp. 341–370, 2 figs., 1 map, 1947.

The following items of phytopathological interest are included in this bulletin. Based on averages of five-year tests, the materials used in the treatment of seed maize were rated as follows: (1) arasan, (2) spergon, (3) semesan jr. and barbak C. Arasan slurry formulation proved equally effective with the dust in two years' tests, if not more so. Throughout Illinois *Gibberella zeae* was the principal agent of stalk rot, to which the inbreds L 317, Ky 27, K 4, and Kys were particularly susceptible. Ear rots were of little importance in 1946. *Fusarium moniliforme* [*G. fujikuroi*] was the most widespread, followed by *G. zeae*, except at one of the localities comprised in the survey, where *Diplodia zeae* predominated [cf. *R.A.M.*, xxi, p. 367 *et passim*].

Hoppe (P. E.). **Seed treatment with mercury dusts injurious to Corn with mechanical injuries near embryo.**—*Phytopathology*, xxxviii, 1, p. 82, 1 fig., 1948.

Severe injury following seed treatment of maize with semesan jr. and Du Pont 1451–D at the normally safe dosages of 1 and 1·25 per cent., respectively, was observed at the Wisconsin Agricultural Experiment Station in 1946. The kernels, the pericarp of which had been ruptured with a scalpel along the edges of the embryo, were dusted on 13th April and planted in the field on 28th May, having been kept during the intervening period in paper packets in the laboratory at room temperature. Seeds similarly injured but planted on the day of treatment sustained no damage and produced large increases in stands of healthy seedlings over the controls, while slitting of the crown and tip-cap was also without adverse effect. In a subsequent greenhouse test seed from a mixture of several commercial hybrids was injured through the pericarp as described above and divided into two lots, one of which was immediately dusted with semesan jr. and the other 76 days later, when both lots were planted. Nearly every seedling from the stored seed developed the stunted and swollen condition typical of mercury injury, whereas those treated at the time of planting were quite normal. It is concluded that storage of the seed between treatment and planting is responsible for the damage in question.

Rhoads (A. S.). **Clitocybe root rot of Citrus trees in Florida.**—*Phytopathology*, xxxviii, 1, pp. 44–61, 6 figs., 1948.

Much of the information in this discussion of the citrus root rot caused by *Clitocybe tabescens* in Florida has already been noticed from other sources [*R.A.M.*, xxi, p. 497; xxv, p. 186, *et passim*]. First identified on citrus in 1929, the disease had evidently been active in the groves for several years previously, but was not recognized owing to confusion with root rot (*Phytophthora parasitica*), the secondary manifestations of which are rather similar. A record, based on a preliminary survey, is presented of the known distribution of the root rot in various counties of the State, and of isolations made of the pathogen. Between 1942 and 1946 the fungus was observed on 210 different plant species belonging to 137 genera and 59 families [cf. ibid., xx, p. 563].

The symptoms of the disease are fully described. Infection is concentrated mostly on and round the root crown, often involving the death of the tap-root and a high proportion of the lateral roots and sometimes inducing a butt rot of the trunk before the top shows any conspicuous symptoms of decline. In many cases, in fact, the sole visible evidence of extensive invasion of the root system is the presence of fresh or dried clusters of fruit bodies at the base of the tree. The structure of the xylostromata frequently developing as hard, blackish, stromatoid extrusions through more or less longitudinal fissures in the root cortex of woody plants attacked by *C. tabescens* is closely comparable with the outgrowths of *Armillaria mellea*, except that with the latter fungus on cacao there is a strong tendency for the xylostromata to develop in the medullary rays [ibid., vi, p. 659]. From studies on the development of the xylostromata in cultures of both fungi in large test-tubes and jars containing lengths of woody stems or roots with the ends in agar in the bottom of the container, it was evident that the xylostromata are merely thickened outgrowths of the mycelial sheets developing between the bark and the wood and extruded through cracks resulting from cortical distension. However, notwithstanding their structural likenesses the xylostromata of *C. tabescens* are not to be confused with the 'shoestring' rhizomorphs of *A. mellea*.

The root rot due to *C. tabescens* is most prevalent on well-drained, sandy soils, especially in sections occupied by oaks or other hardwoods prior to clearing. Roots of such trees attacked by the fungus have repeatedly been found under infected citrus in groves between 9 and 19 years old. Most of the diseased citrus trees observed in Florida, numbering about 340 in this preliminary census, were on rough lemon stocks and some on everbearing lemon, both of which are very susceptible. Seedling sweet orange trees are also prone to infection, whereas the little-used grapefruit stock appears to be fairly resistant and sour orange highly so. Citrus trees in general seem to be much more resistant to *C. tabescens* than many other woody plants, notably *Casuarina* spp.

Surgical treatment of 123 diseased citrus trees proved very successful. It may profitably be supplemented by indefinite exposure of the crown for aeration and drying, while the recovery of trees deprived of a considerable part of their root system can be greatly accelerated by banking the soil round the bases up to a height of several inches above the upper limit of the partial girdle to stimulate the production of new roots from the callus formed at the margin of the living bark.

Bhat (S. S.). **The die-back disease of Citrus trees.**—*Trop. Agriculturist*, cii, 4, pp. 242–246, 1946. [Received April, 1948.]

This is a reprint of a paper already noticed from another source [*R.A.M.*, xxiv, p. 502].

RAYNER (R. W.). **Latent infection in Coffea arabica L.**—*Nature, Lond.*, clxi, 4085, pp. 245–246, 1948.

During investigations into the disease of green Arabica coffee berries caused by *Colletotrichum coffeanum* [*Glomerella cingulata*: *R.A.M.*, xvi, p. 796; xxvi, p. 199] carried out in 1940 and 1941 in Kenya, the author found that practically all pieces of tissue cultured on prune agar yielded the fungus in a large variety of forms; a *Phoma* sp. and a *Phomopsis* were also isolated frequently. The occurrence of these fungi as latent infections on almost all healthy coffee tissues explains the regular presence of their fructifications on tissues which have died from physiological causes and why such disorders have been formerly attributed to fungi.

The strains of *G. cingulata* with short spores, sparse, whitish mycelium, and simple or no chlamydospores were generally isolated from twigs, while those with longer spores, abundant greenish mycelium, and numerous convoluted chlamydospores occurred mostly on green fruits. The strain causing 'brown blight' of ripe berries was of an intermediate type and was also found on leaves and pedicels, an extreme form of it causing 'coffee berry disease'. The spores of this strain are produced separately on branches over the entire mycelium, while those of all the other forms are massed on stromata. Except for occasional minute, yellow spots on mature leaves, doubtfully due to the pathogen, the strains on leaves and stems do not appear to cause any symptoms. Fructifications develop only when the bark dies or the leaves are shed.

Similar variations occur in the *Phoma* sp., the strains differing in spore length and colour of mycelium. The preference of individual forms for certain parts of the plant was also observed. None, however, produced disease symptoms.

It is suggested that premature leaf-shedding, irregular bark-ripening, and uneven berry-ripening may be associated with the development of these less pathogenic, latent-infection fungi in senescent tissues.

KNIGHT (R. L.). **The genetics of blackarm resistance. VI. Transference of resistance from Gossypium arboreum to G. barbadense.**—*J. Genet.*, xlviii, 3, pp. 359–369, 1948.

In further studies on the genetics of cotton blackarm disease (*Bacterium* [*Xanthomonas*] *malvacearum*) [*R.A.M.*, xxvi, p. 395] a strong, partially dominant gene (B_4) governing resistance was transferred from the 'Old World' cotton, *Gossypium arboreum*, to *G. barbadense* (Domains Sakel). B_4 segregates independently of B_1, B_2, and B_3, and has an additive effect in conjunction with B_2 and B_3. This last fact is likely to be important, as immunity (as distinct from resistance) has not yet been found or synthesized in the allotetraploid cottons. The independent segregation of B_4 cannot be regarded as evidence concerning the number of loci affecting resistance unless it is known that a high degree of gene homology exists between the Asiatic genom and the corresponding half of the New World genom. That gene homology exists in some cases is known.

Three cytogenetically distinct methods for transferring genes from Old World diploid to New World allopolyploid cottons are described and their relative merits discussed.

KNIGHT (R. L.). **The role of major genes in the evolution of economic characters.**—*J. Genet.*, xlviii, 3, pp. 370–387, 1948.

The author considers that 'pre-adaptation', i.e., the existence of a character rendering an organism potentially capable of making use of a changed environment or of extending its original environmental limits, is not uncommon in economic characters. Notable examples are found in the resistance of many wild xerophytic species of *Gossypium* to the rain-borne organism *Bacterium* [*Xanthomonas*] *mal-*

vacearum [see preceding abstract] and the resistance of several cottons of non-African origin to leaf curl [*R.A.M.*, xxiii, p. 297; xxiv, p. 449; xxvii, p. 184]. If resistance to *X. malvacearum* has arisen in 'response' to the selective effect of blackarm working in the rain areas where cultivated cottons are grown, one would expect the wild species of *Gossypium* to be susceptible. The fact is, however, that *G. anomalum* is almost immune, *G. somalense*, *G. klotzschianum* and its var. *davidsonii*, *G. armourianum*, *G. raimondii*, and *G. aridum* are resistant, while *G. harknessii* includes resistant and susceptible types.

Marked resistance to leaf curl occurs in some but not all Sea Island cottons. It is found in certain American Upland cottons from India and in some of the diploid species of *Gossypium*, notably *G. thurberi*, *G. armourianum*, *G. aridum*, and *G. raimondii* from the New World and *G. stocksii* from Sind. As leaf curl has been reported only from the Sudan and Nigeria [cf. *C.M.I. Map No.* 125], the resistance in types of non-African origin is clearly pre-adaptational.

Pre-adaptational characters involving major differences will typically be found to be controlled by one or a few large or major genes (i.e., a gene which, compared with its allele, produces a large effect), whereas adaptations arising in 'response' to an existing selection pressure may be controlled either by major or minor genes (genes producing an insignificant effect as compared with their alleles) or both, according to the strength of the genes available. Pre-adaptation is thought to have played a major part in the development of disease and pest resistance and to this is attributed the predominance of major gene control in resistance.

Many valuable crop characters are likely, by reason of their nature, to have complex inheritance, but such 'blending' inheritance is not necessarily wholly polygenic. For breeding purposes an attempt should be made to reduce complex characters to their integral components to facilitate genetic analysis.

Lists are given showing (*a*) 33 crop plants in which major gene resistance to 84 pests and diseases has been demonstrated, and (*b*) 38 plants in which 160 economic characters have been ascertained to be wholly or partly under major gene control; some 50 per cent. of these characters are classified as pre-adaptational. An extensive bibliography is appended.

Ogilvie (L.). **Recent advances in our knowledge of Lily diseases.**—*Lily Yearb.*, xi, pp. 87–92, 8 figs., 1947.

Recent contributions to the understanding of some important lily diseases are summarized with references to 29 papers from the relevant literature, most of which have been noticed in this *Review*.

Bosher (J. E.) & Newton (W.). **A new method of Hyacinth propagation involving additional wounding, the use of fungicidal dusts, and a growth promoting substance.**—*Sci. Agric.*, xxviii, 1, pp. 26–29, 1948.

The development of a *Penicillium* sp., which appears to be the main cause of hyacinth bulb rot [*R.A.M.*, xi, p. 460] during propagation in British Columbia, seems to be inhibited by the common practice of placing the mother bulbs in moist peat or peat plus sand immediately after they are 'scraped' or 'scored'. Preliminary experiments indicated that dusting the wounded surfaces with arasan considerably reduced the losses. This result suggested the development of a new method of propagation in which the mother bulbs are cut around the base to a depth of three or four scales. These scales are removed and cut longitudinally into sections one inch wide; they are then treated with a fungicidal dust and placed in moist peat or peat and sand for three months at 78° to 80° F. The residual cores are similarly dusted and planted in the field immediately.

Scales dusted with arasan produced a much greater number of bulblets than the untreated, and production was further increased by the addition of a trace of

naphthaleneacetic acid to the dust. In further tests spergon and nomersan [ibid., xxvi, pp. 56, 397] gave complete control [cf. next abstract] and the former induced the highest yield of bulblets, namely, 34 from 20 scales, as against 3 for the controls and 19 for nomersan; arasan checked the fungus satisfactorily and yielded 23 bulblets.

Bosher (J. E.) & Newton (W.). **The control of Penicillium spp. on Tulip and Iris bulbs in storage by fungicidal dusts.**—*Sci. Agric.*, xxviii, 1, pp. 47–48, 1948.

Various fungicides were tested for the prevention of losses in British Columbia caused by *Penicillium* spp. on tulip and iris bulbs [*R.A.M.*, xiv, p. 366; xix, p. 598] during storage, especially after prolonged damp weather. One hundred each of uninjured Orange King tulip and Wedgwood iris bulbs and the same number of wounded bulbs (scraped with a knife) were dusted by shaking in paper sacks with excess of fungicide. The bulbs were then placed on moist peat and loosely covered with oiled paper. Spergon, arasan, Dow No. 5, and nomersan effectively prevented the development of *Penicillium* spp. [cf. preceding abstract] on both injured and sound tulip and iris bulbs maintained under humid storage conditions. The mould coverage ratings, expressed by numerical values from 0 to 10, on the treated bulbs were 0 to 1·5, on the untreated 6 to 8·5.

Nienow (Inez). **The identification and characterization of a virus causing mosaic in Mertensia virginica.**—*Phytopathology*, xxxviii, 1, pp. 62–69, 1 fig., 1948.

In 1935 Johnson and Valleau reported (*Res. Bull. Ky agric. Exp. Sta.* 361, pp. 239–263) the occurrence in the common bluebell (*Mertensia virginica*) in Kentucky of a virus transferable to Turkish tobacco, producing chlorotic and necrotic rings on old inoculated leaves and a cucumber mosaic-like mottle on new ones. In 1946 mosaic symptoms were observed on the same widely distributed perennial in Illinois and the virus responsible for the condition was identified by serological and cross-protection tests, host range, and insect transmission as *Cucumis* virus 1 [cucumber mosaic virus]. Among the plants contracting infection on inoculation with the virus from *M. virginica* were *Antirrhinum majus* (reacting by distortion, stunting, and precocious flowering); spinach beet (*Beta vulgaris* var. *cicla*) (systemic mottling and necrosis); *Calendula officinalis* and *Petunia hybrida* (systemic mottling); *Datura stramonium* (chlorotic spots followed by systemic mottling); tomato (fern leaves and mottling); *Nicotiana glutinosa*, *N. repanda*, *N. sylvestris*, and tobacco (necrosis, stunting, and systemic mottling); spinach (necrosis and stunting); *Tagetes patula* (stem and petiole necrosis); cowpea (primary necrotic lesions), and *Zinnia elegans* (mottling and distortion). With the exception of *D. stramonium*, juice inoculations from all these plants resulted in the development of local lesions on cowpea leaves.

The virus from *M. virginica* was inactivated by ten minutes' exposure to a temperature between 65° and 70° F. The result of ageing experiments demonstrated the advisability of working with the virus within a two-hour period to obviate a decrease in infectivity. The virulence of the infective principle was enhanced by 0·1 M phosphate buffer, and the optimum hydrogen-ion concentration for inoculation on cowpea leaves was found to be pH 6·5. The virus was not transmitted through the seeds of diseased *N. repanda*, *N. glutinosa*, or tobacco plants, but it was conveyed by *Myzus persicae*, after a week's feeding on infected *N. glutinosa*, to the same host and *N. repanda*.

The importance of *Mertensia virginica* as a new host of cucumber mosaic virus lies in the fact that, as a perennial, it is capable of harbouring the virus indefinitely and so constituting a reservoir of infection for susceptible plants.

Dillon Weston (W. A. R.), Loveless (A. R.), & Taylor (R. E.). **Clover rot.**—*J. agric. Sci.*, xxxvi, 1, pp. 18–28, 2 pl., 1 graph, 1946. [Received April, 1948.]

Clover sickness caused by *Sclerotinia trifoliorum* [*R.A.M.*, xxvi, p. 60] is widespread in North America, Western Europe, and in parts of Britain, especially East Anglia and Yorkshire. It is a limiting factor to successful clover cultivation and a serious economic problem on the Continent. The disease affects clovers, lucerne, *Onobrychis sativa*, *Medicago lupulina*, and vetches to varying extents. Field peas appear to be infected only by artificial inoculation. Although ascospores of both the bean (*Vicia faba*) [ibid., xviii, p. 628] and clover strains of the fungus react identically on both hosts, the name *S. trifoliorum* var. *fabae* has been retained for the bean rot organism until further ascospore measurements have been taken.

Sclerotia of *S. trifoliorum* can produce apothecia when buried down to 2 in. in soil and spore discharge may continue for four weeks. The disease may be spread by ascospore infection, by sclerotia mixed with seed, in farmyard manure, or on soil adhering to implements. Self-sown red clover plants frequently serve to carry over the disease, which occurs also on corn sowthistle (*Sonchus arvensis*). An examination of 1,000 diseased bean stems revealed that sclerotia on the stems occurred most frequently at a height of 2 to 7 in., thus thousands of sclerotia are likely to be harvested with the haulm even from a lightly infected 10-acre field if a 5-in. stubble is left. Sclerotia were viable for three months or more in dung when buried near the surface.

Control measures include the replacement of heavy dressings of organic and nitrogenous manures by lime, potash, and phosphates; grazing sheep on overluxuriant crops; avoidance of too-frequent cropping with susceptible hosts, especially on heavily infested land where at least eight years should elapse before sowing red clover or winter beans; practising deep and early ploughing where possible to prevent the formation of apothecia; use of clean seed; and using infected bean haulm or clover hay for litter before the uninfected to ensure its incorporation into the lower layers of dung in the yards.

Smith (D.). **The reaction of strains and varieties of Alfalfa to seedling infection by downy mildew.**—*J. Amer. Soc. Agron.*, xl, 1, pp. 189–190, 1948.

At the Wisconsin Agricultural Experiment Station, where lucerne downy mildew (*Peronospora trifoliorum*) [*R.A.M.*, xxv, p. 215; xxvi, p. 156] was exceptionally severe in seedling plots in the spring of 1947, marked differences in the reactions to the disease of 17 strains and four varieties were observed in replicated and randomized tests. The average number of heavily infected plants ranged from 4·5 per cent. for C–35 to 32·1 for C–51. Next in order of resistance came C–130, A–214–Syn. 1, and Grimm, with 5·3, 7·5, and 9·6 per cent. infection, respectively, and of susceptibility C–41, C–54, C–57, and 636–1704, with 28·4, 25·5, 25·1, and 21·7, respectively. The remainder, including Ladak, Buffalo, and Ranger (13·6, 15, and 15·2 per cent. downy mildew, respectively), fell into the intermediate group.

Fischer (G. W.). **Hybridization between Ustilago striiformis and U. bullata.**—Abs. in *Phytopathology*, xxxviii, 1, p. 9, 1948.

Using *Agropyron trachycaulum* and *Elymus canadensis* as common hosts, ten F_1 hybrids between *Ustilago striiformis* forma *hordei* and two races of *U. bullata* [*R.A.M.*, xxvii, p. 231] were obtained from pedigreed monosporidial cultures of opposite sex. Every one of the F_1 sori was of the striate type characteristic of *U. striiformis* [ibid., xxvi, p. 110], although in nine of the hybrids sporulation tended to occur in the glumes and flag leaf rather than in the lower leaves. The erratic germination of the F_1 spores precluded the development of monosporidial cultures, so that the F_2 generation had to be derived directly from the F_1 spores. The low percentage of infection obtained in the F_2 did not permit the determination

of genetic ratios of segregation. Three of the F_1 hybrids produced only the striate sorus type in the F_2, in another the sori were exclusively of the head type, two segregated into both forms, and four were abortive. The F_1 spores were minutely echinulate as compared with the prominent spines in *U. striiformis* and the roughly verrucose texture of *U. bullata*. In the F_2 the sori of the head type contained verrucose spores and those of the striate type echinulate ones.

Osborn (W. L.). **Importance of blind seed disease in Rye grass.**—*N.Z. J. Agric.*, lxxv, 6, pp. 595–602, 7 figs., 1947.

This is a general survey of the present knowledge of blind seed disease (*Phialea temulenta*) [*R.A.M.*, xxvi, p. 549] affecting perennial rye grass [*Lolium perenne*] and the future research programme to be carried out in New Zealand, where the disease continues to cause very serious economic losses.

First-harvest areas were found to give the highest germination, tests in 1946–7 showing that the germination of seed from Dunedin district from first-harvest areas was 79 per cent. compared with 46 and 31, respectively, for second- and third-harvest areas.

Farmers are urged to make use of the pre-harvest testing stations set up by the Department of Agriculture.

Manley (H.). **The use of iodised fruit wrappings.**—*Brit. Packer*, ix, 9, pp. 2–3, 15. 2 graphs, 1947.

Summarizing the results of some important experimental work in England, the United States, South Africa, India, and elsewhere on the use of iodized wrappings for the protection of fruit against mould contamination [*R.A.M.*, xiv, p. 321; xvii p. 470, *et passim*], the writer concludes that this method is superior to any other at present available, giving a minimum general reduction in wastage of 50 per cent. The appropriate concentrations of the solution of iodine (in methylated spirits) and potassium iodide (in water) used for the impregnation of the paper wraps or wood shavings are 1·5 and 1 to 2 per cent., respectively. The British food laws are very restrictive, but there seems to be no reason why the treatment in question should not be extended to eggs and other foodstuffs liable to fungal infection.

Leben (C.) & Keitt (G. W.). **Greenhouse tests of an antibiotic as a protectant spray.**—Abs. in *Phytopathology*, xxxviii, 1, p. 16, 1948.

In greenhouse tests [in Wisconsin] ethanol solutions of an unidentified antibiotic substance produced by a species of *Streptomyces* were effective as protectant sprays against apple scab [*Venturia inaequalis*: *R.A.M.*, xxvi, p. 202]. Under certain conditions the ethanol in these sprays was markedly injurious to the treated plants, but no damage occurred on apple, tomato, or peas when the antibiotic was carried in 25 per cent. ethanol in water or in water alone. The more effective of these preparations, containing 3 to 6 arbitrary units of the antibiotic, as measured by plate assay with *Glomerella cingulata*, completely controlled apple scab and tomato early blight [*Alternaria solani*] in greenhouse experiments, and artificial rain tests indicated that the active material resisted washing on the foliage of these hosts. When apple leaves were inoculated with *V. inaequalis* four days after spraying with the antibiotic there was some diminution in the efficacy of the treatment. Yields of 3 to 5 units of the active material per ml. of culture filtrate have been obtained from tank fermentation.

Groves (A. B.). **Apple rust controlled by airborne applications of fermate.**—Abs. in *Phytopathology*, xxviii, 1, p. 11, 1948.

A single air-borne application of fermate on 11th May, [? 1947], at the rate of $7\frac{1}{2}$ oz. per gal. per acre, reduced the incidence of apple rust [*Gymnosporangium*

juniperi-virginianae] from an average of 17·94 to 1·05 lesions per leaf (over 94 per cent.) on the poorest of the seven-acre plots of 30-year-old Yorks and Winesaps included in a fungicidal trial [in Virginia] beginning at the pink and continuing through the first cover sprays.

Crowdy (S. H.). **Treatment of Apple canker lesions with plant-growth substances.** —*Nature, Lond.*, clxi, 4087, pp. 320–321, 1948.

The effects were observed of various growth substances on *Nectria galligena* [*R.A.M.*, xxvii, p. 74] grown either on 2 per cent. malt agar (pH 4·8) plus 100 p.p.m. of the substances or in liquid nutrient solutions containing varying concentrations of the substances. None was strongly fungicidal, although the more toxic caused a marked reduction in growth.

In preliminary field experiments β-indolyl butyric acid, applied to apple cankers at a strength of 1 per cent. in lanoline, caused a marked improvement over the controls.

Miller (V. L.), Johnson (F.), & Allmendinger (D. F.). **Fluorine analysis of Italian Prune foliage affected by marginal scorch.**—*Phytopathology*, xxxviii, 1, pp. 30–37, 1 fig., 1 map, 1948.

Chemical analysis of the leaves of Italian prune trees suffering from a non-parasitic marginal scorch and leaf spot in various districts of western Washington from 1944 to 1946 revealed an abnormally high fluorine content as compared with samples collected in other localities free from the trouble [cf. *R.A.M.*, xvi, p. 701; xxv, p. 565]. For instance, the fluorine content of six samples collected 90 miles and upwards from an aluminium factory ranged from 6 to 15 p.p.m. as against 30 to 1,400 p.p.m. in 76 from areas within 20 miles. Within a given area the incidence of marginal scorch was roughly proportional to the fluorine content of the foliage; this reverted to near normal during the growing season following the closure of two aluminium factories in the vicinity and the disorder did not recur. Analyses made during the dormant season indicated that a certain amount of fluorine is stored in the twigs, but translocation into the growing leaves does not occur to any significant extent.

Reeves (E. L.), Wright (C. M.), & Williams (H. E.). **The occurrence and transmission of little Cherry in Washington.**—Abs. in *Phytopathology*, xxxviii, 1, pp. 2–3, 1948.

Little cherry [*R.A.M.*, xxvi, p. 204], first observed in four orchards in three sections of the State of Washington in 1946, was found to be widespread in the survey of 1947. A total of 172,078 bearing cherry trees was inspected on 2,458 properties in 16 counties east, and five west, of the Cascade Mountains. Altogether 289 infected properties were located in 13 of the easterly counties, comprising in all 1,471 trees, or less than 1 per cent. of the total number examined. The disease is believed to have been present in the State for about five years. Bud inoculation tests on 27th June, 19th August, and 18th September, 1946, on six healthy Bing and two Lambert trees resulted by the following midsummer in the definite transmission of the virus to four trees of the former variety and both the latter, whereas of four root-inoculated Bings only one contracted infection. A voluntary tree-removal programme has been instituted for the control of the disease.

Demaree (J. B.). **Diseases of Strawberries.**—*Fmrs' Bull. U.S. Dep. Agric.*, 1891, 28 pp., 12 figs., 1948.

This is a slightly revised edition of the *Bulletin* already noticed [*R.A.M.*, xxi, p. 463].

Ruggieri (G.). **Osservazioni sopra una nuova malattia dei frutti di Mandorlo.** [Observations on a new disease of Almond fruits.]—Reprinted from *Nuovo G. bot. ital.*, N.S., liv, 1–2, 6 pp., 3 figs., 1947. [English summary.]

During August, 1945, and again in August, 1946, fully ripe almonds of the Calabrisa variety (which represents about one-half of the almond trees grown in the vicinity) at Forza d'Agro, Sicily, showed 33 per cent. kernel infection by a disease which adversely affected both the appearance and flavour of the fruit.

The nuts, dried in the sun, appeared healthy, but the seeds and the fibrovascular bundles of the endocarp were found to be light grey to greyish-chestnut, or to have light-grey areas on a chestnut background. They bore thin, interwoven, white fungal threads or a fine white powder, or both. Isolations from infected material constantly gave a fungus referable to *Hyalodendron*. Inoculations of moist, healthy seeds with this organism gave positive results when they were moist. Infection did not spread among stored almonds either from the affected to the healthy parts of one kernel or from one almond to another. Isolations of the fungus from almonds kept in the laboratory at 10° to 15° C. in winter and 30° to 36° in summer could be made from 30 per cent. of the kernels after 15 months. The available evidence strongly suggests that primary infection occurs at the base of the fruit, where a small opening arises at ripening. The optimum temperature for the growth of the fungus is 29° to 30°. Further investigations are in progress.

Ruggieri (G.). **Nuova malattia dell' Olivo.** [A new Olive disease.]—Reprinted from *Ital. agric., 1946*, 7, 6 pp., 4 figs. [? 1947.]

In March, 1946, the smaller branches of a Bella di Spagna olive tree at Giarre, Sicily, which had begun to wilt the previous summer, were either completely defoliated or bore only a few chlorotic or dried-up leaves; some twigs had apparently healthy bark, but that of the majority was yellowish or brown. The main branches, trunk, and roots appeared to be healthy.

There was a conspicuous discoloration in the wood of all aerial stems, appearing in transverse sections as sparse, isolated spots or large, continuous uniform areas, and in longitudinal sections as continuous bands from a few mm. to several cm. wide. The vessels were occluded by gum, there was an abnormal production of tyloses, and thin hyphae were also present, both interwoven and free. The condition was a typical tracheomycosis. Numerous isolations constantly gave a *Verticillium* closely resembling *V. albo-atrum*. The same fungus was later isolated from two Nocellara olive trees near Mascali. Inoculation experiments are in progress.

Frear (D. E. H.). **A catalogue of insecticides and fungicides. Volume I. Chemical insecticides.**—x+203 pp., 6 figs., Waltham, Mass., The Chronica Botanica Co., London, W. Dawson & Sons, Ltd., 1947. $6·50.

This compilation, which has been made as complete as possible up to January, 1944, is based on approximately 6,000 fungicides and insecticides mentioned in the literature of the subject and several thousand more from unpublished data [*R.A.M.*, xxvi, p. 189]. The author has collected, particularly, information on the less commonly used materials; the literature on widely used substances is not completely covered. The compounds listed are named according to the nomenclature adopted by the American Chemical Society and used in *Chemical Abstracts*, while all the plant names conform to those in Standardized Plant Names (second edition, 1942, J. H. McFarland Company, Harrisburg, Pa).

Each compound is assigned a code number which is made up from the numbers given to each constituent group of the compound in a given code list. The figures for the constituent groups of each compound making up each code number are

arranged in numerical order beginning with the lowest. The compounds listed are arranged in order of their code numbers, the organic compounds coming first and the inorganic last, but for readers who prefer to locate compounds by name a complete alphabetical index is provided at the end of Volume II.

Lists of condensation and miscellaneous products not coded, an author and reference index, and a patent list, are appended.

GAVAUDAN (P.). **Fungicidal substances: activity.**—*Mem. Serv. Chim. État*, xxxii, pp. 418–442, 1945. [French. Abs. in *J. Text Inst. Manchr*, xxxix, 2, p. A93, 1948.]

The fungicidal activity of 139 organic or organo-metallic compounds was investigated, using *Sterigmatocystis nigra* [*Aspergillus niger*], *Penicillium notatum*, and *Saccharomyces ellipsoideus* as test fungi. Dinitrothiocyanobenzene, the most powerful of the compounds studied, proved fungicidal *in vitro* at a concentration of 0·0001 mol. gm. per l., this being the minimum effective dosage. Altogether the maximum number of active agents was found in the thiocyanate group. Molecules of the benzylphenol and trichlorohydroquinone types destroyed the experimental fungi at 0·0005 mol. gm. per l., which is of the same order of activity as exerted by naphthols. The nature of the metal would appear from a study of copper complexes to be of little account, nor does its presence materially affect the original toxicity of the organic compound.

BALLU (T.). **Le poudrage électrique.** [Dusts applied by electricity.]—*Rev. hort., Paris*, N.S., xxx, 19, pp. 333–334, 1 fig., 1947.

The electrical apparatus for applying fungicidal dusts was devised by the firm of Truffaut and Hampe, the hypothesis being that positively charged dust particles would be attracted to the negatively charged leaf surface, thus giving the double advantage of sure coverage and good adherence. In one experiment, in which a laurel leaf was exposed to non-electrified dusts, no trace adhered to the smooth, shiny surface, but when the current was turned on the dust was evenly distributed over the leaf surface and could not be dispersed by blowing. The electrified dust was also superior in that it did not clot because its particles having a like charge repelled one another.

The particles can be charged either by friction or by creating an 'ionised field'. It was found that ejection of dust from an aeroplane was sufficient to produce a slight electric charge. An arrangement for the electrification by friction consists of two sheets of rubber kept slightly apart by the pressure of the air containing the dust, which is driven through at a pressure of 150 gm. per sq. cm. In the electric field method gas molecules are split into ions; the positive ones are absorbed by an electrode and the negative ones, swept along in an 'electrical wind', impart their charges to the dust particles. They are projected and guided towards the plant by a machine which can be attached to the dusting apparatus and carried on the back, and will create a difference of potential of an intensity (30,000 to 100,000 volts) that will not diminish too much with distance of the air shaft from the plant. This machine, adapted by Néel and Felici, uses condensers of varying capacity with compressed nitrogen as a dielectric. It can produce 50,000 volts, is mounted on an ordinary knapsack sprayer, has a volume of 1 cubic dm., weighs about 2 kg., and is set in action by the lever controlling the dusting machine. For the nozzle, the original metal tube is replaced by one insulated with bakelite, inside which is a deflector bearing several metal points connected with the electrostatic machine. This nozzle serves to project the dust and the ions by which it is electrified and creates the electric field through which the particles are guided towards the plant.

Reckendorfer (P.). **Immunisierung als Folge von Schädlingsbekämpfung.** [Immunization a result of pathogen control.]—*Pfl. SchBer., Wien*, i, 5–6, pp. 65–81, 1947.

An attempt was made to measure the amount of ionized copper deposited in plant tissues and cells by absorption through the leaf cuticle. Three- to five-week-old bean [? *Phaseolus vulgaris*] leaflets were left for 48 hours with one-half of the lamina submerged in a 0·012 per cent. copper sulphate solution. The leaves were then thoroughly washed in distilled water until no trace of copper remained on their surfaces, cut at the immersion line, and the surface areas of the leaves measured. After drying for 72 hours at 110° C. the material was incinerated and the copper content estimated with rubeanic acid (F. Feigl, Qualitative Analyse mit Hilfe von Tüpfelreaktionen, Akad. Verlagsgesellschaft, Leipzig, 1931). The immersed halves contained 608 γ, the non-submerged 200 γ copper. From this amount of infiltrated copper per sq. cm. of leaf surface was calculated and this divided by the number of cells (about 800,000) gave $10^{-5}\gamma$ copper per cell for the submerged and $5\times10^{-6}\gamma$ for the non-submerged. The copper deposits in the petiole and stem sections were calculated similarly.

Experiments with leaves submerged in 1·5 per cent. Bordeaux mixture for 24 hours contained $10^{-6}\gamma$ copper per cell. When five-week-old bean leaves were infiltrated for 72 hours with a copper sulphate solution (30 mgm. copper per l.) by the Roach leaf-stalk infiltration method [*R.A.M.*, xviii, p. 539] the leaves contained 1 to $2\times10^{-6}\gamma$ copper per cell.

It is concluded that an early prophylatic treatment with copper compounds produces copper deposits of $10^{-6}\gamma$ per cell, and because of the physiological union of these deposits with the cell constituents a reaction may be induced giving rise to active resistance in the field.

Cohen (S. L.). **Development of fungicidal aerosols as foliage protectants.**—Abs. in *Phytopathology*, xxxviii, 1, p. 6, 1948.

Of 34 chemicals representing 13 organic classes which were tested for solubility in, or compatibility with, freon-12 and then 'screened' as an aerosol solution for toxicity to plants and their pathogens [cf. *R.A.M.*, xxvii, p. 249], one organic copper formula conferred 96·5 to 100 per cent. protection for 15 to 30 days against rose black spot [*Diplocarpon rosae*], powdery mildew [*Erysiphe polygoni*] and anthracnose [*Colletotrichum lindemuthianum*] of bean [*Phaseolus vulgaris*], and tomato early blight [*Alternaria solani*]. It also effectively eradicated the pathogen from 24-hour-old lesions of bean powdery mildew. Two applications at 15- and 22-day intervals reduced the incidence of carnation rust [*Uromyces dianthus*: ibid., xxiii, p. 236] by 39·1 to 60·6 per cent. on three varieties. A method was devised of increasing the deposit of aerosol droplets on lower and vertical surfaces sufficiently to inhibit the sporulation of two fungi. Certain deposits withstood four minutes' washing in laboratory tests without appreciable loss of fungitoxicity, while 17 to 30 days' ageing did not perceptibly impair their efficiency. In the case of one formula, the occupation of only 0·23 per cent. of the total surface area by the aerosol droplets resulted in 100 per cent. inhibition of spore germination by *Stemphylium sarciniforme*.

Wolf (F. A.) & Wolf (F. T.). **Fungi.** Volume I: 438 pp., 153 figs.; Volume II: xii, 538 pp., 63 figs., 19 graphs, New York, John Wiley & Sons, Inc., London, Chapman & Hall, Ltd., 1947. Volume I $6.00 [36*s.* net], Volume II $6.50 [39*s.* net].

Volume I of this treatise, which is designed to serve as a reference and text-book, deals with the developmental morphology and taxonomy of fungi and falls into

eight chapters, viz. (1) the founding of morphology; (2) isolation and cultivation of fungi; (3) classification and taxonomy of fungi; (4) the Myxomycetes; (5) the Phycomycetes; (6) the Ascomycetes; (7) the Basidiomycetes; and (8) the Deuteromycetes (Fungi Imperfecti).

Volume II is concerned more specifically with the metabolic and reproductive activities of fungi, their modification by environment, and the relationship of fungi to human welfare. Its emphasis, therefore, is on their physiological and ecological aspects. The chapters are headed (1) nutrition of fungi; (2) enzymes and enzymic activities of fungi; (3) respiration; (4) biochemistry of fungi; (5) effects of temperature on fungi; (6) effects of radiation on fungi; (7) effects of reaction of substrate on fungi; (8) spore dissemination; (9) germination of spores; (10) host penetration; (11) physiologic specialization and variation among fungi; (12) associative effects among fungi; (13) mycorrhiza and mycotrophy; (14) genetics of fungi; (15) poisonous and edible fungi; (16) medical mycology; (17) geographical distribution of fungi; (18) mycology in relation to plant pathology; (19) soil fungi; (20) fungus-insect interrelationships; (21) marine fungi; (22) fossil fungi. Author and subject indices are appended to both volumes.

A number of mistakes in the text detracts from the value of this useful work.

Reinmuth (E.). **Pflanzensoziologie und Pflanzenschutz.** [Plant sociology and plant protection.]—*NachrBl. dtsch. PflSchDienst*, N.F., i, 4, pp. 66–69; 5–6, pp. 91–93, 1947.

Some interesting examples from the current literature are cited and discussed of the application of plant-sociological principles to problems of plant protection.

Newman (I. V.). **Aerobiology on commercial air routes.**—*Nature, Lond.*, clxi, 4086, pp. 275–276, 1948.

While in a commercial flying-boat travelling from New Zealand to the United Kingdom in September, 1947, the author exposed for five minutes at 140 knots (approximately 160 m.p.h.) microscope slides mounted on a stick, carrying either potato dextrose agar plus protein (about 10 sq. cm. surface) or glycerine jelly containing a little carbol fuchsin [cf. *R.A.M.*, xxvii, p. 248]. The slides were stored under cellophane and so arranged that successive removals left the remaining slides still protected from dust. After exposure cover-slips were added. More rigorous methods of preparation and protection are recommended, however, for similar studies.

Different strains of *Cladosporium herbarum* were trapped over the Gulf of Carpentaria, the Island of Sumbawa, and the Strait of Bonifacia. Over the Tasman Sea only eight colonies (awaiting identification) were secured. One slide, exposed at 2,100 ft., showed practically no catch, possibly because the wind at that point had crossed New Zealand in the neighbourhood of the Cook Strait. Slides bearing 16 and 299 fungus colonies, representing 70 and 1,680 fungal spores, respectively, per 100 cu. m. of air, were those exposed in wind which had probably crossed Australia.

The author encourages biologists to use these simple methods when travelling by air in order to contribute to the knowledge of aerobiology.

Westergaard (M.) & Mitchell (H. K.). **Neurospora V. A synthetic medium favouring sexual reproduction.**—*Amer. J. Bot.*, xxxiv, 10, pp. 573-577, 1 fig., 1947.

A synthetic medium which promotes the sexual cycle in *Neurospora crassa* consists of 0·1 per cent. potassium nitrate, 0·1 potassium dihydrogen phosphate, 0·05 magnesium sulphate, 0·01 calcium chloride, 0·01 sodium chloride, 5 μgm. biotin per l., trace elements, 2 per cent. sucrose, and 1·5 per cent. agar, adjusted

to pH 6·5. For mutants the addition of yeast extract, malt extract, hydrolysed casein, vitamin mixture, or a combination of all four is recommended.

The assaying of penicillin.—*Nature, Lond.*, clxi, 4086, pp. 285–287, 1948.

At a meeting of the Society of Public Analysts and other Analytical Chemists held [in London] on 29th January, 1948, the purpose, scope, and validity of methods of penicillin assay were reviewed. The discussion was based on two distinct problems, namely, the assay of total penicillin and the assay of individual penicillins [*R.A.M.*, xxvi, pp. 556, 557].

Texera (D. A.). **Production of antibiotic substances by Fusaria.**—*Phytopathology*, xxxviii, 1, pp. 70–81, 1948.

When several saprophytic and plant-pathogenic species of *Fusarium* were cultured in simple synthetic media, such as dextrose nitrate (Czapek-Dox) broth, they readily produced antibiotic substances [cf. *R.A.M.*, xxvi, p. 207]. This property was quickly lost when the stock cultures were perpetuated by mass transfer but was regained through the propagation of individual spores.

Further experiments with *F. hyperoxysporum* [*F. oxysporum* f. 2] from sweet potato [ibid., xxvii, p. 176] showed that the antagonistic potency of this fungus against the Gram-positive bacteria could be somewhat enhanced by two-membered cultivation with *Escherichia* [*Bacterium*] *coli* in sterile soil. This association, however, did not lead to the inhibition of the bacterium by the fungus.

The quantity of zinc present in the medium was shown to govern the qualitative antagonistic behaviour of *F. oxysporum* f. 2. In the presence of this element the fungus produces an antibiotic acting mainly on Gram-positive bacteria, whereas in its absence both the latter and Gram-negative organisms are inhibited. Both principles were isolated from mass cultures of *F. oxysporum* f. 2 and designated provisionally as fractions A and B.

In its mode of formation and anti-bacterial spectrum, fraction A is distinct from penicillin, chaetomin, and fumigacin, while B presents some analogies with penicillic acid. Further work is necessary, however, to determine the true nature of these active principles.

Yousef (H. M.). **The mycorrhizas of Iris germanica albicans Lange and Asparagus sprengeri Regel.**—*Proc. Egypt. Acad. Sci.*, ii (*1946*), pp. 45–61, 1 fig., 16 diags., 1947.

A tabulated survey is given of the distribution of vesicular-arbuscular mycorrhiza among 13 plant families, specimens of which were obtained in the vicinity of Cairo. Of the 35 species examined, 18 showed mycorrhizal infestation, including *Colocasia antiquorum*, *Richardia africana* [*Zantedeschia aethiopica*], *Cryptostegia grandiflora*, chilli, *Datura stramonium*, *Petunia hybrida*, *Solanum nigrum*, *Withania somnifera*, *Calendula officinalis*, *Coreopsis tinctoria*, *Gerbera jamesonii*, sunflower, and *Zinnia elegans* [cf. *R.A.M.*, viii, p. 663; xv, p. 178].

Cytological studies were carried out on the mycorrhiza of white *Iris germanica* and *Asparagus sprengeri*. In the former the fungus [*Rhizophagus*: ibid., xviii, p. 470] is only intracellular, coiling within the cortical cells immediately below the exodermis and giving rise to arbuscules in the deeper layer. Joint infection by an unidentified Phycomycete and *Rhizoctonia*, as described by Peyronel [ibid., iii, p. 539], was observed. Inoculation of the roots with the latter species resulted in the formation of monilioid cells, stromata, and occasionally pelotons in the outer cells.

The mycorrhizal fungus of *A. sprengeri* is both intra- and intercellular and forms vesicles of variable shape, usually terminal but sometimes intercalary, 15 to 140 by 12 to 58 μ. The arbuscules of the *A. sprengeri* endophyte remain intact much

longer than those of *I. germanica*, but they are ultimately digested in the same way. Plants of *A. sprengeri* grown under sterile conditions formed tuberous roots, so that this process is evidently not dependent on mycorrhizal infection, as suggested by Bernard and Magrou [ibid., xxiv, p. 243].

The different views prevailing as to the physiological significance of endotrophic mycorrhiza are briefly discussed.

Perlman (D.). **On the nutrition of Memnoniella echinata and Stachybotrys atra.**—*Amer. J. Bot.*, xxxv, 1, pp. 36–41, 1948.

Several sources of nitrogen and carbon, the latter obtained from some twenty sugars and sugar derivatives, were utilized by *Memnoniella echinata* and *Stachybotrys atra* [*R.A.M.*, xxvii, pp. 84, 148] during growth, which was increased by adding traces of iron, zinc, or manganese to the basal nutrient solution but decreased by the toxic action of cobalt. Past experiments, in which biotin was found to be the only essential growth-promoting substance [ibid., xxv, p. 413], were extended to show that *dl*-O-heterobiotin accounts for 10 to 15 per cent. of its growth-promoting activity on a weight basis. The biotin requirement was markedly reduced by the addition of aspartic acid to the medium.

Black (W.) & Driver (C. M.). **Potato breeding.**—Final Report No. 1248, Item No. 22, British Intelligence Objectives Sub-Committee, 31 pp., London, H.M. Stationery Office, 1947. [Mimeographed.]

This report falls into three sections, of which the first summarizes the information collected at each of the eight German 'targets' visited in October, 1946, comprising two commercial seed-growing organizations and six plant-breeding Research stations; the second is a survey of potato breeding in Germany, discussing the general aims pursued; and the third is concerned with the organization of the work. Much valuable material has been collected on the progress to date in breeding for resistance to viruses, notably leaf roll, to late blight (*Phytophthora infestans*), and wart disease (*Synchytrium endobioticum*), and an interesting and readable account is presented of the problems awaiting solution and the methods adopted for dealing with them.

Problems associated with the Potato.—*Ann. appl. Biol.*, xxxiv, 4, pp. 622–636, 2 diags., 3 maps, 1947.

At the meeting of the Association of Applied Biologists held in London in October, 1947, J. G. Hawkes, describing observations on wild and cultivated indigenous potatoes from the Americas, deals from the plant-breeder's point of view with the attempts that have been made to solve problems of disease attack and adaptation to new environment. After referring to the work in progress at the Commonwealth Potato Station, Cambridge, where 1,500 lines are maintained, he discusses the taxonomy, distribution, and cytology of the tuber-bearing species of *Solanum* with reference to breeding and other work on diseases and pests. The geographical distribution is described and the classification of the subsections and subdivisions of the genus outlined. Characters of economic value are listed and the question of chromosome numbers is discussed with reference to the relationship of the species and groups, and their ability to hybridize with the *Tuberosa* types.

W. Black discusses blight [*Phytophthora infestans*] in relation to breeding work carried out at the Scottish Plant Breeding Station [*R.A.M.*, xxvii, p. 151]. In 1946 a fourth strain of the fungus, D, was isolated. It appeared on a selection immune from A, but failed to attack varieties susceptible to B and C. It seems to be a weak form of C, from which it differs only quantitatively. The inheritance of resistance to the strains A, B, and C and breeding experiments elucidating this are described; major genes Rc and Rbc [ibid., xxiii, p. 147] conferring immunity

from strains A and C, and from A, B, and C, respectively, are postulated. Evidence of an increased virulence in B is adduced. He concludes that qualitatively different strains of blight may develop, as shown by B and C, and that quantitative differences in virulence may be displayed in the development of qualitatively different lines, as indicated by the plasticity of B and D. The ultimate number of recognizable strains is likely to be large, and would appear to depend on the range of test plants available for differentiation of the fungus.

A. E. W. Boyd states that in Scotland the acreage of the Doon Star potato variety has declined from 12,000 in 1942 to only 1,960 in 1946, mainly because of its susceptibility to dry rot (*Fusarium caeruleum*) [ibid., xxv, p. 8; xxvi, p. 79]. A preliminary account is given of investigations, carried out by the Agricultural Research Council in co-operation with the Department of Agriculture for Scotland, on time and manner of infection and on control. Field and laboratory experiments have shown that *F. caeruleum* is essentially a wound parasite, but even a severe wound is no longer susceptible to attack as soon as new callus tissue has been formed (usually in two to eight days). The only other avenue for infection is through lesions caused by *Spongospora subterranea*. Contaminated boxes and stores play no material part in the development of the disease if the tubers are undamaged. By far the most important factor is damage sustained on the riddle, digger and associated lifting injury being only of relatively minor importance. Losses may, possibly, be reduced by a different system of dressing. Rough handling of the bags may double the number of diseased tubers, and the amount of dry rot in one stock can be varied from 3 to 42 per cent. merely by changing the handling conditions. The amounts of dry rot that developed after hand-dressing, machine-riddling, and machine-riddling twice were, respectively, 4, 16, and 24 per cent. Transport appears to have only a secondary effect upon riddled potatoes and relatively little on hand-dressed tubers. Bagging or clamping instead of boxing after riddling increased dry rot, and wetting the tubers before riddling and bagging increased it.

Very satisfactory control resulted from dipping the tubers in organo-mercury solutions immediately after lifting and dressing, the tubers then being boxed. Several small-scale laboratory tests indicated that thymol vapour [cf. ibid., xxv, p. 8] almost completely inhibited the growth of even large colonies of *F. caeruleum*, which were killed after 8 to 14 days.

Trials of Potatoes for immunity from wart disease.—*J. Minist. Agric.*, liv, 12, pp. 574–575, 1948.

A further descriptive list is given of new potato varieties found, in trials by the Ministry of Agriculture in collaboration with the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland, to be immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, xxv, p. 182]. They are (early) Ulster Prince, (second early) Ulster Emblem, (early maincrop) Red Fife and Ulster Leader, and (late maincrop) Craigs Bounty [ibid., xxvii, p. 151] and Ulster Supreme.

Cook (H. T.). **1947 results—late blight forecasting.**—*Food Packer*, xxviii, 13, pp. 63–64, 1 graph, 1947.

Using the method of prediction recently described [*R.A.M.*, xxvi, p. 360], four forecasts of potato and tomato late blight [*Phytophthora infestans*] development were issued from the Virginia Truck Experiment Station at weekly intervals beginning on 15th May, 1947. All stated that the prevailing weather conditions were unfavourable to the pathogen, and the last two advised growers that the disease was unlikely to be important during the current season. The forecasts proved to be correct, no general outbreak of late blight occurring and over 90 per

cent. of the potato and tomato acreage in the eastern portion of the State being entirely free from the disease. Growers were thereby saved the expense of needless spraying and dusting, the cost of which for the two crops would have amounted to $2,000,000.

[This report was reprinted in *Plant Dis. Reptr*, xxxii, 2, pp. 54–57, 1948.]

CASTBERG (C.) & EMILSSON (B.). **Undersökningar beträffande bekämpning av bladmögel och brunrota hos Potatis. I. Preliminare bestämningar av den kvarsittande förmågan hos kopperhaltiga besprutningsmedel.** [Studies relating to the control of Potato late blight and brown rot. I. Preliminary determinations of the adhesive capacity of copper-containing spray preparations.]—*K. LandtbrAkad. Handl., Stockh.*, lxxxvi, 3, pp. 196–204, 1947. [English summary.]

A tabulated account is given of the determinations made in 1946 at several localities in Sweden of the spray retention of a number of copper fungicides used in potato blight [*Phytophthora infestans*] control, the copper residues being estimated by chemical analysis of samples from 50 leaflets selected at random.

At the concentrations used in this investigation the absolute retention of copper was considerably larger for Bordeaux mixture than for the other sprays tested, including copper oxide (perenox), copper oxychlorides (Ob 2300 and cuzol), and copper silicate (kopsit) [*R.A.M.*, xxvi, p. 351]. Thus, in the principal trial on the Magnum Bonum variety at the Plant Research and Cold Storage Institute, Nynäshamn, beginning on 5th August, the initial amounts of copper deposited on the foliage (in mg. per sq. cm. leaf surface) by 2 per cent. Bordeaux mixture, the same plus estol H, 1 per cent. Ob 2300, 1 and 2 per cent. cuzol, 0·5 and 1 per cent. kopsit, 0·4 per cent. perenox, and 4 per cent. Bordeaux powder special were 131, 107, 57, 24, 42, 13, 27, 49, and 75, respectively, the corresponding figures on the 22nd being 42, 42, 17, 8, 18, 3, 5, 13, and 17, respectively, and the late blight ratings, in a scale where 0 corresponds to freedom from infection and 5 to tops completely shrivelled, 0·3, 0·3, 2, 2, 1·8, 3·2, 2·8, 1·7, and 1·8, respectively.

These data were corroborated by those obtained in the other tests, and it is concluded that the clear-cut superiority of Bordeaux over the alternative fungicides is due in the main to the larger initial deposits of copper on the foliage, but also to its higher percentage of retention [ibid., xxvi, p. 506].

SANFORD (G. B.). **The occurrence of bacteria in normal Potato plants and legumes.**—*Sci. Agric.*, xxviii, 1, pp. 21–25, 1948.

In tests carried out at Edmonton, Alberta, during several successive years from 1939, thin sections cut aseptically from the steles of apparently healthy potato and bean (*Phaseolus vulgaris*) stems, and of tap-roots of lucerne and other *Medicago* spp. and sweet clover (*Melilotus* spp.) and incubated on potato dextrose agar yielded a mixed bacterial flora [*R.A.M.*, xxii, p. 395].

PERRAULT (C.). **L'antagonisme de certains micro-organismes envers Corynebacterium sepedonicum.** [Antagonism of certain micro-organisms to *Corynebacterium sepedonicum*.]—*Canad. J. Res.*, Sect. C, xxv, 6, pp. 185–188, 2 pl., 1947. [English summary.]

Four *Actinomyces* spp., four *Penicillium* spp., and a *Chaetomium* sp. isolated from rotted potato tubers affected with ring rot produced anti-bacterial substances which impeded or prevented the growth of the causal organism, *Corynebacterium sepedonicum* [*R.A.M.*, xx, p. 376; xxvii, p. 91], on agar media. One bacterial culture and one *A.* sp. produced a lysis of *C. sepedonicum*; three other organisms appeared to stimulate its growth.

Wager (H. G.). **Quality of Potatoes in relation to soil and season II. The colour of the cooked Potato.**—*J. agric. Sci.*, xxxvi, 3, pp. 214–221, 1 fig., 8 graphs, 1946. [Received April, 1948.]

In this study of stem-end blackening of potatoes [*R.A.M.*, xxvii, p. 153] the author found that samples from fen, blackland, sand, gravel, limestone, and chalk soils blackened more than those from skirt, silt, warp, clay, and boulder clay. The average blackening of samples was influenced by both season and locality but not by the pH of the tubers.

Hooker (W. J.) & Sass (J. E.). **Evidence of parasitic activity of Actinomyces scabies on seedling roots. Some histological features of Potato stem necrosis associated with Actinomyces scabies.**—Abs. in *Phytopathology*, xxxviii, 1, p. 14, 1948.

It has previously been shown that seedling roots of various plants develop severe necrosis when grown in soil-water agar artificially infected with *Actinomyces scabies*, whereas no such effects followed the use of cultures non-parasitic to potato [cf. *R.A.M.*, xxvi, p. 260]. A similar but milder necrosis developed on soy-bean and wheat roots in quartz sand inoculated with *A. scabies*. There was no evidence that such necrosis was induced by a water-soluble substance secreted by the pathogen on potato dextrose agar. Sections revealed numerous hyphae in the rhizosphere and in the epidermal and cortical cells of the diseased roots grown in agar even though the root was not necrotic. Dilution plate counts showed *A.* spp. to be considerably more abundant in the rhizosphere of field-grown oat roots than in soil containing no roots. The hyphae of an Actinomycete were detected in sections of Clinton oat roots grown in northern Iowa peat soil.

In the second abstract it is stated that potato varieties known to be susceptible to tuber scab developed extensive stem necrosis due to infection by *A. scabies*, whereas varieties resistant to tuber scab were also comparatively free from stem necrosis. In plants grown in the greenhouse in sterilized peat soil inoculated with the fungus, infection was often established in the stems through unwounded surfaces away from stolons and secondary roots. In this type of lesion the periderm was absent or at most poorly developed and discontinuous in the susceptible Red Warba, Katahdin, Cobbler, Pawnee, and Chippewa, the cortical cells of which also contained abundant hyphae of an Actinomycete. On the other hand, in the resistant Menominee and Cayuga and two unnamed clones, the periderm was well developed and continuous, with sparse intracellular mycelium. This relationship was not consistently maintained in the case of natural field infection of resistant and susceptible varieties. Where stem infection in the field occurred through natural wounds, such as longitudinal splits, or at points of emergence of stolons and secondary roots, periderm formation tended to be poor, even in resistant varieties, and mycelium was often profuse.

Das (C. R.) & Baruah (H. K.). **Experimental studies on the parasitism of Rice by Helminthosporium oryzae Breda de Haan and its control in field and storage.**—*Trans. Bose Res. Inst.*, xvi (*1944–46*), pp. 31–46 [? 1947. Received March, 1948.]

In Bengal *Helminthosporium oryzae* [*Ophiobolus miyabeanus*: *R.A.M.*, xxvi, pp. 167, 510] causes wastage of paddy in the field and rice in storage, the incidence of the disease in nature being influenced by the type of seeds used, the presence of infective units in the soil and grasses, and climatic conditions.

In soil inoculation experiments, using natural, infected, waterlogged, and waterlogged infected soils the number of diseased plants was higher in the waterlogged than in natural soil and in the Aman varieties, Indrosail and Latisail, than in the

Aus, Katakara and Dhariwal. After one month the totals of diseased plants in the two Aman varieties in natural, infected, waterlogged, and waterlogged infected soils were 5 and 15, 7 and 21, 43 and 38, and 85 and 95, respectively, the corresponding figures for Aus being 9 and 4, 31 and 8, 16 and 41, and 17 and 50, respectively. The time required for the appearance of foliar symptoms was three to four days for Dhariwal, six to seven for Bhasamanik and Nagra, and four to five for Jhingasali, Chinsura, Patnai, Latisail, and Tilak Kachuri.

The influence of the stage of maturity of the plant on resistance to *O. miyabeanus* was studied by inoculating two Aus varieties, Dhariwal and Kataktara, at 22, 44, and 66 days of age, which resulted in infection percentages of 70 and 55, 55 and 30, and 10 and 5, respectively.

Further experiments on the Bhasamanik (Aman) variety showed that the total number of infections is greater on scraped than on intact tissues; with inoculum of spores in protein extract and 0·5 per cent. glucose than in sterile water; and on the leaf than on the stem. Exposure to chloroform vapour for 30 minutes to destroy the resistance of the epidermis increased the number of infections on sound Bhasamanik and Chinsura (Aman) tissues.

The effect of the composition of the medium on the growth rate of *O. miyabeanus* was investigated, and the linear spread of the colony was found to reach a maximum of 85 mm. in five days on Dox, the corresponding figures for rice plant and root extracts and modified Duggar being 82, 71, and 74, respectively. The addition to the basic Dox medium of 1, 10, and 20 per cent. rice plant extract, 312 mg. rice plant ash, 594 mg. grass ash, and 508 mg. unhusked rice ash increased the spread of the colony in five days from 85 to 86, 98, 93, 116, 106, and 122 mm., respectively. Peptone was the best of five sources of nitrogen tested. The fungus made no growth in the absence of carbohydrates but produced 228, 312, and 425 mg. mycelium per 100 c.c. medium in nine days in the presence of 1 per cent. glucose, sucrose, and starch, respectively, while the maximum yields of 2,128, 2,472, and 1,380 mg. were secured by the addition to the medium of 20, 10, and 5 per cent., respectively, of the three carbon sources. Manganese sulphate at 0·5 per cent. increased the dry weight on Dox from 362 to 756 mg. The growth rate was further stimulated by the admixture with the medium of 10 c.c. unhusked paddy or rice extract or 1 per cent. yeast powder, in the presence of which the spread of the colony in five days was 100, 95, and 70 mm., respectively, compared with 62 mm. in the control plates. The optimal pH for growth was found to lie between 5·8 and 7·6.

Ocfemia has shown that the fungicidal treatment of infected paddy seeds does not kill the dormant spores or mycelium lying between the husks inside the ridges [ibid., iv, p. 121], but in the writers' experiments encouraging results were obtained by seed treatment with diphenyl at concentrations of 0·05 to 1 per cent., as well as by storage in gunny bags impregnated with the chemical at 0·2 per cent. [ibid., xxvi, pp. 486, 542]. A reduction of the relative humidity in the storage chambers from 100 to 82·2 per cent. temporarily inhibited the development of infection, but none occurred even after three months in the presence of diphenyl. Deep irrigation to remove the source of infection in the soil, burning diseased grasses and other refuse, and the use of healthy seed of resistant varieties are also recommended for the control of *O. miyabeanus*.

KEYWORTH (W. G.). **Mosaic disease of the Hop. A study of tolerant and sensitive varieties.**—*Rep. E. Malling Res. Sta., 1946*, pp. 142–148, 1 pl., 1 fig., 2 maps, 1947.

The objects of the present investigation (started in 1942) were (1) to determine the proportion and distribution of carriers of hop mosaic virus in commercial Fuggle gardens, (2) to observe the effect of planting Fuggles adjacent to Goldings in commercial gardens, (3) to select mosaic-sensitive and tolerant male varieties in

order to propagate them commercially, and (4) to determine the reaction to mosaic disease of a number of Wye seedlings *R.A.M.*, xxvii, p. 42].

Single cuttings from three widely separated hills from each of 32 surveyed Fuggle gardens in the Weald of Kent were inarched in a glasshouse to mosaic disease-free Golding indicators. Vein-clearing developed in the indicators after five or six weeks and proved to be a reliable symptom indicating mosaic disease in the test plants. At least 78 of the 92 grafted Fuggle plants were mosaic carriers. Grafted Fuggle cuttings from 12 farms in the Teme Valley, Worcestershire, showed that at least 47 out of 61 were carriers of the disease.

In 1940, in a Worcestershire Golding garden, some grubbed Golding plants with mosaic disease were replaced by Fuggles. In 1942 at least 50 per cent. of the remaining Goldings showed mosaic symptoms. On a Kent farm Canterbury Goldings had been growing next to Fuggles for at least 10 years, separated by a 12-ft.-broad alley. In 1942 the Goldings showed 16 per cent. plants with mosaic disease. On another Kent farm, however, mosaic-sensitive Golding and Fuggle carriers had been growing on adjacent plots for about 15 years (also separated by a 12-ft. alley), with very little spread of mosaic disease to the Goldings. This problem evidently requires further study, but in the meantime the growers are advised not to plant Fuggles and Goldings in proximity.

The author's survey of Golding gardens in the West Midland area confirmed the suggestion [ibid., ix, p. 131] that male plants are carriers of the mosaic virus. One or more male cuttings per hull from two gardens containing mosaic-tolerant female varieties and two with female varieties sensitive to the virus were inarched to mosaic-sensitive Golding varieties, and other male cuttings from the same sources were inarched to known carrier plants of the Wye variety 0063 to determine their ability to display mosaic symptoms. By this method three male sensitive and three male tolerant varieties of different flowering seasons were obtained for further propagation. During the course of this investigation it was found that the progeny of one of the male plants in a Golding garden was a carrier of the disease, but subsequent inspections revealed no infected hills and it appears, therefore, that this male plant was not a source of infection.

Results of glasshouse tests carried out at East Malling, using Wye seedlings tested by the same methods as previously described for male hops, showed that the varieties WFF 28, WFA 111, and OR 76 are sensitive to mosaic disease and 413a, WFF 12, A 00, and 1147 tolerant of the virus.

These methods appear to be practicable for the routine testing of new seedlings for sensitivity to or tolerance of the disease.

KEYWORTH (W. G.). **Notes on varieties of Hop resistant to Verticillium wilt.**—*Rep. E. Malling Res. Sta., 1946*, pp. 157–159, 1947.

Since 1939 some 220 commercial and Wye seedling varieties have been tested for resistance to *Verticillium* wilt [*V. albo-atrum*: *R.A.M.*, xxvii, p. 94]; three were found to be very resistant and four moderately so. Because of the limited numbers of the initial stocks and the demands of the experiments the resistant varieties are at present not available for distribution. OB 53 Nonsuch Hop (rather susceptible to *Sphaerotheca humuli*) [ibid., xxvi, p. 170] and OM 26, both the second generation from a wild hop from Manitoba, Canada, are very resistant, OR 55 (recommended as the best all-round variety), OJ 47, and 219 (susceptible to downy mildew [*Pseudoperonospora humuli*]), all developed from the New Mexican Hop, and 1147 (?) from Bates's Brewer, are moderately resistant. OR 55 and OJ 47 appear to be the most generally acceptable. The resistant AEE 55 has undesirable qualities which will probably make it unacceptable to growers.

CHILTON (S. J. P.) & COOPER (W. E.). **Root rot of Sugar Cane.**—*Sug. J., N.O.*, x, 1, pp. 19–20, 1947. [Abs. in *Sugar*, xliii, 2, p. 53, 1948.]

Out of 4,330 cultures of *Actinomyces* isolated from 108 samples of Louisiana sugar-cane soils, 1,007 (23·2 per cent.) inhibited to some extent the growth of the *Pythium* spp. responsible for root rot [including *P. dissotocum* and *P. periilum*: *R.A.M.*, xxvi, p. 216], but only 13 exerted a high degree of antibiotic activity, almost completely suppressing the development of the pathogens in plate cultures. The number of *Actinomyces* in general, as well as of those with antibiotic properties, was larger per gm. of soil in light than in heavy soils, the Red River territory being particularly prolific in this respect.

[In a later abstract in *Phytopathology*, xxxviii, p. 6, 1948, bringing the number of *Actinomyces* isolates tested for antibiosis to over 6,500, the authors state that five years' comparative tests with sugar-cane on the various soils gave yields correlating with the number of antibiotic *Actinomyces*.]

Barrett (J. T.). **Induced oospore production in the genus Phytophthora.**—Abs. in *Phytopathology*, xxxviii, 1, p. 2, 1948.

Oospore production in some species of *Phytophthora* is known to be rare, erratic, or absent, while in others positive and negative results are given by different isolates. Several workers on the genus have succeeded in stimulating oospore development by the pairing of various isolates of the same and of different species [*R.A.M.*, xxvii, p. 159]. Using two isolates of *P. drechsleri*, one male and the other female, neither producing oospores alone, maleness and femaleness has been determined in species which seldom or never form these organs, e.g., *P. citrophthora*, *P. cinnamomi*, and *P. infestans*. All the isolates of *P. citrophthora* and *P. infestans* tested react as males and those of *P. cinnamomi* as females. All the Californian isolates of *P. cryptogea* behave as males, and one, presumably from South Africa, as female. No oospores have so far developed between *P. citrophthora* (female) and *P. cinnamomi* (male).

Tubbs (F. R.). **Report of the Mycologist for 1946.**—*Bull. Tea Res. Inst. Ceylon* 28, pp. 24–27, [? 1947].

In this report [cf. *R.A.M.*, xxv, p. 282] it is stated that in Ceylon *Rosellinia arcuata* [ibid., xxi, p. 48] is not as widespread on tea as is *Poria* [*hypolateritia*: ibid., xxiv, p. 121], but prompt measures should be taken to prevent spread. When conditions are persistently moist for a long period, the fungus can spread rapidly through a heavy litter of fallen leaves and infect the healthy tea plants with which it comes into contact. Fructifications of *R. bothrina* were found on tea bushes at St. Coombs, but its parasitism has not yet been investigated.

Cercosporella theae [ibid., xxiii, p. 290; xxiv, pp. 75, 121] is stated to cause collar rot of *Crotalaria usaramoensis* and *Tephrosia vogelii* [ibid., xvii, p. 706; xviii, p. 821]. What is believed to be a new species of *Cercosporella* was observed on *Crotalaria anagyroides* killed by collar rot; associated with the fungus were bright-coloured perithecia of a *Calonectria* which proved in culture to be its perfect state.

Manning (J. D.). **A review of developments in the blister blight situation between December 1946 and March 1947. Blister blight situation in April and May 1947.**—*Plant. Chron.*, xlii, 7, pp. 145–150; 8, pp. 177–179; 13, pp. 295–298, 1947.

These current reports on the tea blister blight [*Exobasidium vexans*] situation in South India [*R.A.M.*, xxvii, p. 261] contain much useful information of local interest. The supposition that a critical period in the course of the disease would occur between 20th February and 20th March was proved correct, broadly speaking, but the persistence of the pathogen under favourable weather conditions necessitated an extension of at least another four weeks.

The most significant conclusion to be drawn from the April and May reports of planting associations and managers is the occurrence in all districts of a period

when the incidence of blister blight on estates that had previously been heavily attacked fell to comparatively small proportions, while on those sustaining little damage at an earlier date the amount of infection generally remained slight. Together with shade control, pruning between mid-October and mid-February (with the necessary local adjustments) promises to be the most effective measure against blister blight. In nearly all cases the reduction in the amount of infective material thus obtained permitted the plants to reach the tipping stage, after which they are assumed to be immune from defoliation.

The first part of this review is followed by three appendices addressed to all District Planting Associations, of which I is entitled 'Proposals regarding control of blister blight on an industry-wide basis', II 'The importance of pruning time as a factor in control', and III 'Blister blight control proposals—additional note'.

TUNSTALL (A. C.). **Report on visit to South India in connection with blister blight.**—*Plant. Chron.*, xlii, 8, pp. 179–182, 1947.

During a visit to South India from 16th to 24th February, 1947, the author observed that tea in areas of the Nilgiris and Anamallais pruned between June and October, 1946, had lost all new growth as a result of blister blight [*Exobasidium vexans*: see preceding and next abstracts]. Exceptionally propitious growing conditions permitted a remarkable recovery, but the fresh growth was again attacked though much less severely, except in patches with a north aspect and strips adjoining jungle belts and dense windbreaks, where the area of enhanced susceptibility may extend to 100 ft. The percentage of infection in unpruned tea may be reduced firstly, by the plucking of all foliage down to the small fish leaf, and secondly, by the removal of any diseased leaves, and particularly of the succulent shoots produced within the bushes. In the case of cut-back tea, in which the loss even of blistered leaves tends to impair the health of the plants, spraying with 1 per cent Burgundy mixture or 0·5 per cent. perenox should be carried on until sufficient leaf has been produced for the supply of adequate energy.

The general pattern of the outbreak of blister blight in South India conformed to that observed over a period of many years in the north-east.

MAYNE (W. W.). **Blister blight in the high range.**—*Plant. Chron.*, xlii, 14, pp. 314–317, 1947.

During the six-month period previous to 24th May, 1947, when this address was delivered before a meeting of the Kanan Devan Planters' Association, tea blister blight [*Exobasidium vexans*: see preceding abstracts] reproduction at high elevations in South India was generally of the discontinuous type, involving comparatively slight risk of serious damage. The reduction of shade is considered to be the best means of altering external conditions to the disadvantage of the pathogen, the individual blisters of which are larger and dry off less rapidly under shade than in the open. Close plucking is another means of limiting the amount of susceptible tissue, especially in the incipient stage of infection. Spraying is regarded as impracticable in tea which has passed beyond the first year from pruning.

LUCAS (G. B.). **Comparative cultural studies with Thielavia basicola and Thielaviopsis basicola.**—Abs. in *Phytopathology*, xxxviii, 1, p. 16, 1948.

Thielavia basicola has been reported as the perfect state of the tobacco black root fungus *Thielaviopsis basicola*, the perithecia and ascospores of the former organism having been found associated with the chlamydospores of the latter on diseased roots. However, it has not yet been possible to show that either of these forms would give rise to the other. In comparative cultural studies of the two fungi, *Thielavia basicola* grew rapidly on Richard's agar minus sucrose, with filter

paper as a carbon source, while the development of *Thielaviopsis basicola* was scanty or nil. On carrot slices the relative growths of the two species were reversed. *Thielavia basicola* grew in potato or carrot agar at pH_2 but *Thielaviopsis basicola* did not. A temperature of 37° C. inhibited the development of the latter species while permitting that of the former. Pathogenicity tests with the two fungi on tobacco gave negative results in the case of *Thielavia basicola* and consistently positive ones in that of *Thielaviopsis basicola*. Grown together on various media, the two species showed no tendency to mate. These data provide an amplification of existing evidence that *Thielavia basicola* is not the perfect state of *Thielaviopsis basicola* [*R.A.M.*, v, p. 393].

Gisquet (P.). **Obtention d'une lignée de Nicotiana tabacum L., héréditairement stable, présentant le syndrome tératologique énation, reduit a ses manifestations foliaires.** [Procurement of an hereditarily stable line of *Nicotiana tabacum* L., presenting the teratological syndrome of enation, reduced to its foliar manifestations.]—*C.R. Acad. Sci., Paris*, ccxxvi, 10, pp. 832–833, 1948.

In the F_2 of the tobacco selection known as 'enation 701', resulting from a cross between Java-Isère and Cabot made in 1934 the enation syndrome developed on a few plants, one of which was self-fertilized and its progeny studied. The F_3 fell into two types, enation (701) and non-enation (711) which was entirely normal. Since 1939 the two types have been segregated and remained perfectly stable, the non-enation 711 having, in fact, been cultivated for industrial purposes.

Although the foliaceous outgrowths in enation 701 resemble those induced by certain forms of the sap- and insect-transmissible 'kropoek' [tomato spotted wilt] virus, the former anomaly is distinguishable by its hereditary character, being transmitted by the seed from one generation to the next and not by means of grafting or sap inoculation.

Holmes (F. O.). **A new type of resistance to spotted wilt.**—Abs. in *Phytopathology*, xxxviii, 1, pp. 13–14, 1948.

The [tomato] spotted wilt virus isolated from a recent outbreak of the disease in dahlia and tomato in New Jersey was found to be capable of overcoming the typical resistance of the Pearl Harbor tomato variety, which confers adequate protection against infection in Hawaii [*R.A.M.*, xxv, p. 142]. A new type of resistance applicable to local conditions, as demonstrated by greenhouse and field tests, occurred in a tomato originating in Argentina and was inherited on a monofactorial basis in hybrids with the susceptible Rutgers variety. This new type of resistance, together with that of Pearl Harbor, may be expected to serve the dual purpose of facilitating control of the disease and indicating the geographical distribution of different strains of the tomato spotted wilt virus.

Miller (P. W.) & Schuster (C. E.). **Filbert tree decline and loss. Causes and control.**—*Circ. Ore. agric. Exp. Sta.* 172, 19 pp., 12 figs., 1947.

This circular contains, in an amplified form, information on the chief diseases of older filbert trees [*Corylus avellana*] in the Pacific Northwest already noticed from another source [*R.A.M.*, xxvii, p. 165].

Hepting (G. H.) & Toole (E. R.). **Wilt epidemiology and resistance in the Mimosa tree.**—Abs. in *Phytopathology*, xxxviii. 1, p. 13. 1948.

Within the 12 years since its discovery, the wilt of *Albizzia* [*julibrissin*] caused by *Fusarium* [*perniciosum*: *R.A.M.*, xxiii. p. 366] has spread into 76 counties from Maryland to Alabama. At Morganton, North Carolina, where the disease appeared

on one block in 1943, the trees on 232 blocks were dead or dying by 1947. In a search for wilt-resistant mimosas begun in 1939, 632 seedlings were grown from seed collected from Maryland to Louisiana. After several inoculations the remaining seedlings were planted in infested soil, in which 20 have continued wilt-free for five years, while neighbouring volunteers have died. Eight stem cuttings rooted from the healthy trees and 17 from some random volunteers were inoculated simultaneously; all the latter died of wilt during the first year, whereas all the cuttings from the resistant selections survived. Rooted cuttings from trees selected haphazard from other localities also proved susceptible to *F. perniciosum*, resistance to which would thus appear to be an individual characteristic.

Toole (E. R.). **Distribution of Mimosa wilt in 1947.**—*Plant Dis. Reptr*, xxxii, 2, p. 67, 1 map, 1948. [Mimeographed.]

The vascular wilt of the mimosa tree (*Albizzia julibrissin*) caused by *Fusarium oxysporum* f. *perniciosum* [*F. perniciosum* see preceding abstract] had spread by 1947 to 82 counties in six States of the American Union.

Pomerleau (R.). **Rapport général des travaux effectués sur la maladie hollandaise de l'Orme dans la Province de Québec en 1946.** [General report on the work done on Dutch Elm disease in the Province of Quebec in 1946.]—28 pp., 19 figs., 3 maps, Québec, Service Forestier, Ministère des Terres et Forêts [? 1948. English summary. Mimeoprinted.]

During the summer of 1946, a survey was made of 22,224 elm trees in 46 counties of the Province of Quebec covering an area of 15,000 square miles; samples were taken from 2,985 trees, of which 2,114 were found to be affected by *Ceratostomella ulmi* [*R.A.M.*, xxvii, p. 50]. The disease has now been found in 30 counties, being recorded for the first time in Deux-Montagnes, Montcalm, Vaudreuil, Shefford, Quebec, and Portneuf. It extends over an area of more than 8,000 sq. m. between the city of Quebec and the Ottawa River. Nearly all the affected trees (except those at Ste Anne de Sorel) were cut down before April, 1947.

In preliminary tests conducted during one season on eight-year-old elms, only trees inoculated before 24th July developed outward signs of infection, i.e., leaf-yellowing or withering. Further studies are in progress.

Pomerleau (R.) & Lechevalier (H.). **Étude de l'effet antibiotique d'une bactérie sur le développement du Ceratostomella ulmi (Schwarz) Buisman.** [A study of the antibiotic effect of a bacterium on the development of *Ceratostomella ulmi* (Schwarz) Buisman.]—*Rev. canad. Biol.*, vi, 3, pp. 478–484, 6 figs., 1947. [English summary.]

The authors observed marked antagonism between *Ceratostomella ulmi* [see preceding abstract] and an as yet unidentified bacterium which appeared in culture. The antibiotic effect was due to a diffusible, thermostable, non-filterable substance produced by the bacterium. Spores coming into contact with this substance were modified in various ways and in some cases appeared to lose their viability. Further work is in progress.

Fenner (L. M.) & Fate (L. R.). **Ceratostomella ulmi on Elm bark treated with 2,4-dichlorophenoxyacetic acid.**—*Phytopathology*, xxxvii, 12, pp. 925–928, 2 figs., 1 diag., 1947.

Variations in the length and diameter of the coremial stalks of *Ceratostomella ulmi* comparable with those reported by Schwarz, Wollenweber [and Stapp: *R.A.M.*, vii, p. 683] and Clinton [and McCormick: ibid., xvi, p. 216] have been observed by the writers from time to time in coremia growing in bark beetle [*Scolytus* spp.] galleries in elm and in cultures from the insects. In 1947 coremia

measuring 3 to 4 mm. in length, as against the common range of 0·25 to 1·5 mm., developed on sterilized elm twigs from isolates collected in different parts of the United States.

In September, 1946, abnormally large coremial groups were produced on sterilized elm bark that had been placed in Petri dishes containing 10 to 15 c.c. of a saturated solution of 2,4-dichlorophenoxyacetic acid or its ammonium salt in concentrations ranging from 1 to 6 gm. per 800 c.c. sterilized water. After the inoculation of the bark with a spore suspension of *C. ulmi* the cultures were incubated for 45 days, about three times the period usually required for normal coremial growth. The resultant overgrown bodies, 7 to 20 mm. in diameter, had apparently emerged from large masses of yellowish spore material on the surface of the inner bark. The individual coremia within the fasciated groups were 8 to 10 mm. long from the base of the stalk to the top of the head, and the tabular, flattened stalks measured 0·25 to 1 mm. in width. Hair-like, dark brown synnemata, more or less than 3 mm. long with hyaline, possibly fertile tips, seemed to originate at the top of the stalk and extended above the coremial head. Subcultures from the over-sized, broadly elliptical heads gave rise to apparently normal mycelial colonies after 20 days on potato sucrose agar.

Connola (D. P.), Collins (D. L.), & Hagmann (L. E.). **Log treatments for bark beetle control in connection with the Dutch Elm disease.**—*Bull. Cornell agric. Exp. Sta.* 841, 43 pp., 12 figs., 1947.

This paper describes tests carried out over a period of years at the New York State College of Agriculture to find a means of preventing the spread of the carriers of Dutch elm disease (*Ceratostomella ulmi*) [see preceding abstracts] alternative to the uneconomical method of burning beetle-infested wood. The results of applying various chemical sprays to dead and dying wood and various mechanical measures designed to prevent breeding of the principal bark beetle carriers in the United States, namely, *Scolytus multistriatus* and *Hylurgopinus rufipes* [*R.A.M.*, xxvi, p. 378], are given. As the results of tests with chemicals on logs with thick bark were not encouraging the author considers that such treatments can play only a small part in controlling the Dutch elm disease at present.

Melekhov (I. S.). О повреждениях Еловых лесов северной тайги ржавчинным грибом **Chrysomyxa ledi.** [On the injury to Spruce in the North Siberian forests by the rust fungus *Chrysomyxa ledi.*]—*Symp. Res. Pap. For. Techn. Inst. Archangel*, viii, pp. 59–75, 1946.

In 1944–5 the North Siberian spruce forests were seriously damaged by *Chrysomyxa ledi* [*R.A.M.*, xvi, p. 491; xx, p. 1], the incidence being closely connected with the wide distribution of the alternate host *Ledum palustre* in these regions. Preliminary investigations showed that the most serious infection occurred in wood clearings and tops of the crowns, the least in the undergrowth. It is concluded, therefore, that the fungus requires light for its development. The author envisages great possibilities in aeroplane dusting for the control of the disease. Thorough burning of *L. palustre* is also recommended.

Koperin (F. I.). О влиянии влажности древесины на ее поражаемость грибами. [The influence of wood humidity on its destruction by fungi.]—*Symp. Res. Pap. For. Tech. Inst. Archangel*, viii, pp. 37–48, 1 fig., 1946.

Evidence obtained in tests for the control of *Peniophora gigantea* [*R.A.M.*, xxvi, p. 572] and *Ceratostomella pini* [ibid., xiv, p. 68], which seriously affect stored timber in U.S.S.R., showed that the fungi do not develop at 21 per cent. wood humidity or less. *P. gigantea* grows well on pine [unspecified] at 90 to 255 per cent.

wood humidity, on spruce from 90 to 190, the optimum being approximately 120 per cent. Almost complete absence of air in the wood does not prevent development of the fungi.

C. pini showed abundant growth both on pine and spruce at 30 to 70 per cent. wood humidity, but only slight development at 210 on pine and 150 on spruce, when only the peripheral wood layers were affected.

WEBB (SHIRLEY). **The resistance of some Australian timbers to decay by mine fungi.**—*Proc. roy. Soc. Vict.*, N.S., lviii, 1–2, pp. 3–24, 3 graphs, 1947.

The chief species of wood-destroying fungi, so far identified, isolated from decayed timber or fruiting bodies found in an Australian zinc mine were *Coniophora cerebella* [*C. puteana*: *R.A.M.*, xxvi, pp. 369, 572], *Polyporus zonalis* [ibid., xxi, p. 396], *Trametes serialis* [ibid., xxv, pp. 143, 429; xxvi, p. 88], *Poria xantha* [ibid., xix, p. 573], and *Merulius pinastri* [ibid., viii, p. 280]; *C. puteana* was the most common and most destructive.

To determine the comparative resistance of several Australian hardwood species towards these fungi, pairs of experimental blocks 2 by 1 by 1 in. were oven-sterilized for four days, embedded (except for one corner) in oven-dried soil of different moisture contents contained in screw-top jars [ibid., xix, p. 127], and autoclaved three times. After the final sterilization the projecting corners were inoculated and the bottles incubated for six months at 25° C., after which time the blocks were weighed, oven-dried for eight days, and weighed again. The percentage loss in oven-dry weight from the original was taken to indicate the amount of decay. The same treatment was observed for the controls which were not inoculated. Two series of experiments were carried out for each timber, the soil moisture content in the first being 25 per cent. of the oven-dry weight and in the second 30 per cent. The former accelerated decay in most cases. Blackbutt (*Eucalyptus pilularis*), spotted gum (*E. maculata*), river red gum (*E. rostrata*), and tallow-wood (*E. microcorys*) were outstandingly resistant to fungal attack and were only slightly decayed by *C. puteana*. Brown stringy bark (*E. capitellata*) and Sydney blue gum (*E. saligna*) were very susceptible to *C. puteana* but fairly resistant to less virulent pathogens, while messmate (*E. obliqua*), 'mountain ash' (*E. regnans*), and 'oregon' (*Pseudotsuga taxifolia*) were increasingly susceptible to decay in that order.

An unidentified Basidiomycete (D 2), commonly isolated from hardwood timber with a dark brown, stringy rot, was a very potent wood-destroyer, causing definite decay in the more resistant hardwoods. A *Trametes* sp. and an unidentified sp. A 3 caused some decay in denser hardwoods and very considerable decay in lighter timbers. *M. pinastri* attacked softwoods readily and proved virulently destructive to hardwoods. *P. xantha* and *T. serialis* attacked only the lighter woods.

GUILLAUME (P.). **Préparation et conservation des traverses de chemin de fer.** [The preparation and preservation of railway sleepers.]—*Rev. int. Bois*, xiv, 119, pp. 101–102, 1947.

According to information acquired over a period of years the following rules should be observed in the impregnation of railway sleepers with wood preservatives [*R.A.M.*, xxvii, p. 106]. Healthy and partially dried wood should be thoroughly dried in hot-air chambers (35° [C.] rising to 70°) prior to injection in all seasons, using timbers of the same kind and size. Complete impregnation with creosote heated to 85° to 90° is effected by the Bethell method [ibid., xiv, p. 205; xxiv, p. 348], and the excess oil may be recovered as in the Rueping process [loc. cit.]. It is important that the temperature should remain constant throughout this operation and the amount of preservative retained by the wood carefully controlled by weighing. Until laying commences the treated sleepers should be piled up where

they are not exposed to heat so that the volatile elements in the creosote are retained. The life of oak and beech sleepers treated as described above is about 25 and 30 years, respectively.

PETERS (F.). **Vue générale des procédés et produits de préservation du bois utilisés en Allemagne avant et pendant la guerre en tenant compte particulièrement de méthodes employés par les chemins de fer et les services des postes et du télégraphe du Reich.** [General survey of the methods and materials used in wood preservation in Germany before and during the war, particularly those employed by the Reich railways and postal and telegraph services.]—*Rev. int. Bois*, xiv, 119, pp. 114–118, 1 fig., 2 graphs, 1947.

The five methods of preserving timber used by the German railway and postal and telegraph services [*R.A.M.*, xix, p. 57; xxv, p. 376] are described: they are (*a*) painting and preservation with a liquid [ibid., xxii, p. 120]; (*b*) immersion; (*c*) the Boucherie method [ibid., xxi, p. 235]; (*d*) osmosis [ibid., xx, p. 505; xxii, p. 84]; and vacuum pressure [ibid., xxi, p. 277], of which the last-named is now the most popular.

KÜHLWEIN (J.). **Méthodes de vérification de laboratoire des produits pour la protection du bois.** [Laboratory methods for the testing of wood protectives.]—*Rev. int. Bois*, xiv, 119, pp. 110–113, 3 figs., 1947.

The author recommends that the following fungi [*R.A.M.*, xxv, p. 376] should be used for testing the efficacy of wood preservatives; *Coniophora cerebella* [*C. puteana*] and *Polyporus vaporarius* [*Poria vaporaria*] for most types of wood, and in addition *Lentinus squamosus* [*L. lepideus*] for pinaster [*Pinus pinaster*] sleepers, *Polyporus* [*Polystictus*] *versicolor* for beech sleepers, *Lenzites abietina* for pine telegraph poles, and *Merulius domesticus* [*M. lacrymans*] for building woodwork in the open air.

Two methods of testing are described, using wood blocks [ibid., xxv, p. 588; xxvii, p. 209]. By one method standard blocks usually of pinaster sapwood are dried at 150° C., dipped in preservative, and exposed to wood-destroying fungi grown on malt agar in Kolle flasks. After about three or four months at a temperature of 18 to 22° and a relative air humidity of 60 to 70 per cent. the difference between the initial and final dry weights indicates the extent of destruction. This can also be assessed after drying in air by observing cracks or other signs of rotting on the surface of the blocks.

By another method, from which results can be obtained in about four weeks, test-tubes containing gradually decreasing amounts of malt agar and correspondingly increasing amounts of preservative solution, added while still liquid, are thoroughly shaken, sloped, the agar solidified by chilling, and inoculated. The limiting value at which the fungus is just killed can finally be obtained.

COSSLETT (V. E.) & MARKHAM (R.). **Structure of Turnip yellow mosaic virus crystals in the electron microscope.**—*Nature, Lond.*, clxi, pp. 250–252, 3 figs., 1948.

Electron micrographs of turnip yellow mosaic virus [*R.A.M.*, xxv, p. 284] mounted on beryllium films showed a hexagonal lattice structure, suggesting that the micro-crystals are of a diamond type. The diameter of a rigid spherical particle fitting best with the data would be 19·5 mμ; that of dry particles (measured from electron micrographs and by other methods) was 22 mμ.

The beryllium films were prepared according to the method described by Hast [*Nature, Lond.*, clix, pp. 354, 370, 1947]. One droplet of the virus suspension in distilled water is placed on a collodion film carried on a nickel specimen grid. After

drying a layer of beryllium about 50 Å thick is evaporated on to the surface; the collodion is then dissolved away, leaving the virus supported by the beryllium alone on the nickel grid.

Beryllium films give much clearer micrographs of virus and similar particles and enable more accurate particle measurements to be made than with collodion films, which cause greater background scattering. Exposure to the electron beam, however, causes a clouding-over of the virus in a few minutes.

Doyle (R. J.). **Controlling Sugar Beet blackroot.**—*Sugar*, xlii, ii, pp. 36–37, 1 fig., 1947.

Following up the results of laboratory studies by L. W. Koch and A. A. Hildebrand and field tests by H. Fletcher, excellent control of sugar beet black root [*R.A.M.*, xxvii, p. 4] has been obtained at the Plant Pathological Laboratory, Harrow, Ontario, by soil treatments with arasan at the rate of 3 lb. per acre. The isolation (for the first time in Canada) by W. McKean of an [unspecified] 'water mould' led to further trials in 1946, when torrential tornado rains in June provided ideal conditions for this destructive pathogen, and the stands from arasan-treated fields were fully 3½ times better than the controls. On this basis the fungicide was recommended to growers, to be applied with the fertilizer and in single bands along the rows, with outstanding results in 1947 at the cost of only $3.50 per acre.

Kotila (J. E.). **Rhizoctonia foliage blight of Sugar Beets.**—*J. agric. Res.*, lxxiv, 11–12, pp. 289–314, 10 figs., 1947.

In this expanded account of his studies on foliage blight of sugar beets due to *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xxii, p. 284] the author states that the disease has since been found in Colorado and Maryland. Its maximum development is favoured by temperatures between 21° and 25° C. The fungus may cause pre- and post-emergence damping-off of sugar beet seedlings and was shown by inoculation experiments to be pathogenic to beans (*Phaseolus vulgaris*), lucerne, Italian ryegrass (*Lolium multiflorum*), brome grass (*Bromus inermis*), and potato. The perfect state, found almost exclusively on the ventral side of the leaves and on the petioles of sugar beet, corresponds morphologically with *Pellicularia filamentosa* [ibid., xxv, pp. 66, 80] and is commonly found in the field whenever the disease is prevalent. Field observations (confirmed by experiments under greenhouse conditions) indicated that the basidiospores play an important part in spread, germinating within 12 hours on the leaf.

Single basidiospore isolates displayed cultural characters differing distinctly from those of the mycelial isolate from which they were obtained. They also differed among themselves in growth habit [cf. ibid., xxvi, p. 508]. They varied widely in pathogenicity to sugar beet seedlings, infection ranging from 100 per cent. to almost none; on sugar beet foliage infection ranged from mild to severe. Isolates of *C. solani* from a number of plants were induced to develop the perfect state in two weeks by growing them in sugar beet plants.

Tomaszewaski (W.). **Gegenwartsprobleme der Pflanzenquarantäne.** [Present-day problems of plant quarantine.]—*NachrBl. dtsch. PflSchDienst*, N.F., i, 4, pp. 62–66, 1947.

The urgent need for the reorganization of the German plant inspection and quarantine service is the theme of this lecture, delivered at a meeting of the Plant Protection Committee of the German Agricultural Society on 5th February, 1947. Some of the problems connected with this project are discussed and the essential conditions for its realization defined.